

THE PLANKTONIC COPEPODS OF THE NORTHEASTERN ATLANTIC OCEAN: SOME TAXONOMIC OBSERVATIONS ON THE ONCAEIDAE (CYCLOPOIDA)

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SYNOPSIS

A new genus belonging to the family Oncaeidae is described. It differs from all other genera in the family by the possession of a 2-segmented endopod in legs 1-4 and a 2-segmented second antenna. Descriptions of three new species and the hitherto undescribed males of two species are also given. The other thirteen species found in the samples are briefly described and figured.

INTRODUCTION

ALL THE important families of planktonic cyclopoid copepods, except the Oncaeidae have been the subject of a major revision; the Corycaeidae by Dahl (1912), most of the Sapphirinidae by Lehnhofer (1926 & 1929) and the Oithonidae by Rosendorn (1917). It is not surprising, therefore, to find that it is primarily within the Oncaeidae, which contains numerous small and often difficult-to-separate species, that taxonomic problems occur. Also many new taxa are being discovered which have previously escaped detection either by their exceedingly small size or by the remoteness of their bathypelagic habitat. Thus, when a series of plankton hauls from the Atlantic was analysed priority was given to taxonomic studies on the members of the family Oncaeidae present in the samples. In the following account the new taxa and rare species are described in detail and, as a basis for future comparative studies, brief descriptions of the commoner species are given because modern descriptions of these are often not available and older descriptions are incomplete.

MATERIALS AND METHODS

The material described below was first lent and then donated to the British Museum (Natural History) by the Institute of Oceanographic Sciences at Wormley. It consists of a day and night series of vertical hauls made with a horizontally towed, opening and closing, net system which was acoustically controlled. The copepods were caught in a rectangular midwater trawl (RMT 1) of 1 m² mouth area and a mesh of 0.32 mm. The net system and method of fishing are described by Baker *et al.* (1973). Twenty-eight hauls were made in November 1969 at station 7089 (18°N, 25°W) in the Atlantic near the Cape Verde Islands. The depth of each haul is given below together with the fraction of the sample examined.

The copepods were stained in chlorazol black in lactophenol, dissected and examined in lactophenol and mounted as permanent preparations in polyvinyl lactophenol. The preparations were examined by phase contrast microscopy and drawings were made with the aid of a camera lucida.

SAMPLE (HAUL) NUMBER	DEPTH (m)	FRACTION
35	10-0	1/8
33	10-0	1/64
31	20-10	1/32
28	25-10	1/64
30	50-20	1/32
27	60-25	1/32
26	100-49	1/64
20	100-55	1/32
23	200-110	1/16
19	194-112	1/16
25	290-210	1/16
3	300-210	1/16
11	400-300	1/8
29	400-305	1/8
24	500-410	1/8
22	500-410	1/8
17	600-505	1/8
13	600-515	1/8
16	700-610	1/8
9	700-610	1/8
15	785-700	1/8
5	790-700	1/8
4	890-800	1/8
12	900-800	1/8
8	1010-900	1/8
14	1020-910	1/8
34	1220-1000	1/8
32	1250-1000	1/8

DESCRIPTIONS OF SPECIES

PARALUBBOCKIA gen. nov.

DIAGNOSIS. Body elongate; urosome 5-segmented in ♀, 6-segmented in ♂. First antenna 7-segmented in ♀, 5-segmented in ♂. Second antenna 2-segmented with 4 setae. Mandible a curved process with 2 strong spines and a hirsute seta. First maxilla bilobed; outer lobe with 3 (♀) or 4 (♂) apical setae, inner lobe with 1 (♂) or 2 (♀) lateral setae. Second maxilla (♀) with elongate basal segment and terminal segment bearing 5 elements; (♂) squat, indistinctly 2-segmented with 2 subapical elements. Maxilliped prehensile, 4-segmented. Legs 1-4 with 3-segmented exopods and 2-segmented endopods; armature formula:

	Coxa	Basis	Endopod	Exopod
Leg 1	0-0	1-0	0-1; 0, I, 5	0-0; 0-1; I, I, 4
Leg 2	0-0	1-0	0-1; 0, II, 5	I-0; 0-1; I, I, 5
Leg 3	0-0	1-0	0-1; 0, II, 4	I-0; 0-1; I, I, 5
Leg 4	0-0	1-0	0-1; 0, II, 2	I-0; I-1; I, I, 5

Leg 5 a free segment with 2 terminal elements.

TYPE-SPECIES. *Paralubbockia longipedia* sp. nov.

ETYMOLOGY. The generic name refers to the close resemblance in general facies between the new genus and *Lubbockia* Claus, 1863.

Paralubbockia longipedia gen. nov. et sp. nov.

DESCRIPTION. *Female*. Body elongate, pointed anteriorly (Fig. 1a); prosome longer than urosome; rostrum small and rounded; relative lengths urosome somites and caudal rami 15:33:15:12:14:11. Caudal rami about 1.5 times longer than broad.

First antenna (Fig. 1c) extending posteriorly beyond margin of cephalosome; fourth segment providing about half the length of the appendage; armature elements on segment I - 1, II - 3, III - 3, IV - 5, V - 3, VI - 2, VII - 6.

Second antenna (Fig. 1b) 2-segmented; long proximal segment with a hirsute seta on lateral margin; distal segment with 3 hirsute setae increasing in size towards the apex with 2 rows of fine setules on the lateral surface.

Mandible (Fig. 1d) a curved tapering process with 2 stout spines on the convex margin, a proximal hirsute seta and a row of bristles.

First maxilla (Fig. 1e) comprising 2 unequal lobes; the larger inner lobe with 2 setae, the small outer lobe with 3 hirsute setae around the apex.

Second maxilla (Fig. 1f) with an elongate basal segment and a small terminal segment bearing 2 curved apical spines, both with rows of spinules on their concave margins, and 3 hirsute setae on the inner margin.

Maxilliped (Fig. 1g) 4-segmented with a long claw-like distal segment; second segment with a continuous row of spinules along inner margin and 2 naked setae; claw with a spinule row on proximal half of concave margin, spinules increasing in size distally.

Legs 1-4 (Figs 2a-d) with 3-segmented exopods and 2-segmented endopods; armature formula as in generic diagnosis. Spines on both rami bilaterally serrate except for apical spine of exopod which is externally serrate and internally plumose; rows of setules present on lateral margins of endopod segments and inner margin of exopod segment 1; 5 long spinules located on inner margin of basis of leg 4. Left member of leg 2 pair aberrant in holotype with 2 inner setae on exopod segment 2 and only 4 inner setae on exopod segment 3.

Leg 5 (Fig. 1h) a free segment with 2 naked apical setae and a lateral seta located on surface of somite near base.

Leg 6 probably represented by unarmed cuticularized plate located near genital aperture.

Body lengths of 4 complete female specimens 1.43, 1.26, 1.19 and 1.37 mm.

Male. Similar to female in general appearance; urosome (Fig. 3a) 6-segmented; posterior margins of urosome somites 3 to 5 provided with a continuous dentate hyaline frill on ventral surface; anal somite with a row of fine spinules posteriorly. Caudal rami shorter than anal somite.

First antenna (Fig. 3b) 5-segmented with the distal segment representing the fused fifth to seventh segments of the female; fourth segment extremely long as in female; armature elements on segment I - 1, II - 5, III - 2, IV - 4, V - 10.

Second antenna (Fig. 3c) as in female.

Mandible a slightly curved blunt process without armature elements but this may possibly be due to damage during dissection.

First maxilla (Fig. 3d) similar in form to that of female but with 4 setae on outer lobe and with only 1 seta on inner lobe.

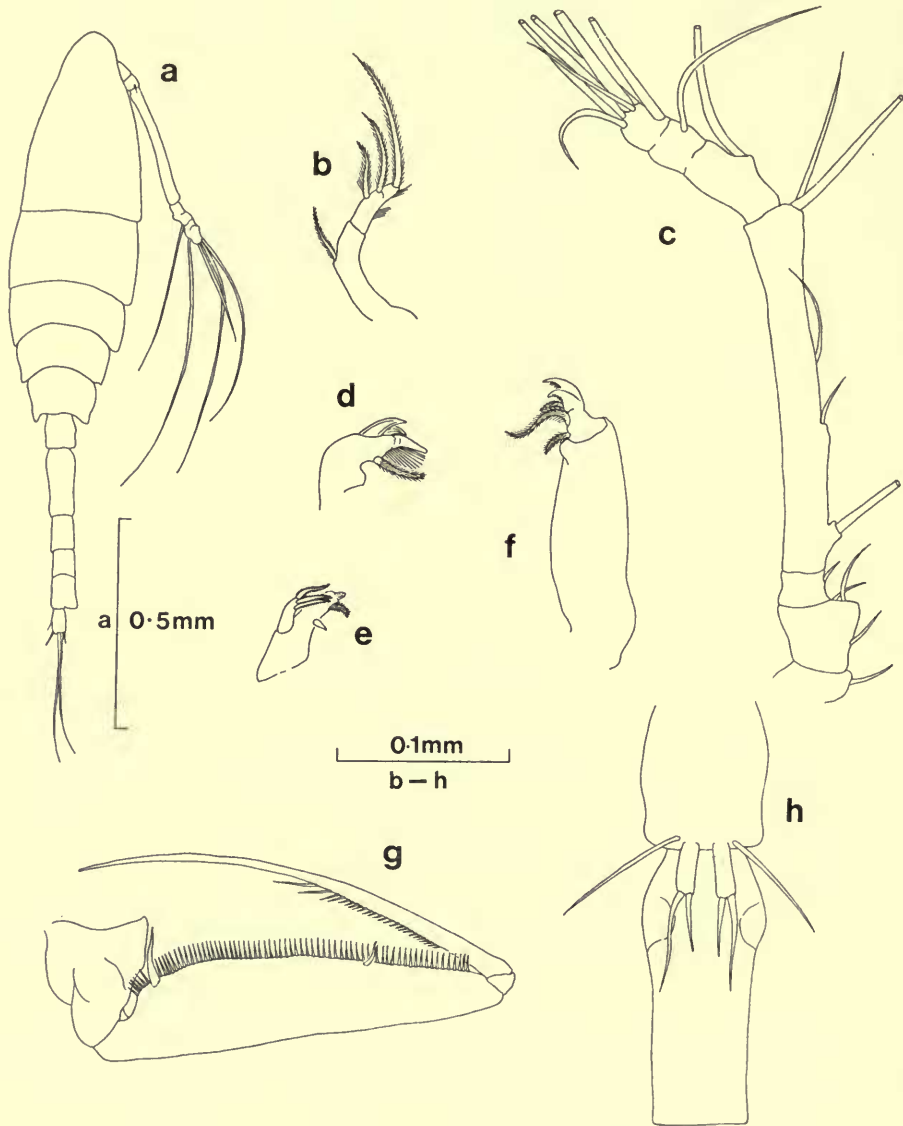


FIG. 1. *Paralubbockia longipedia* gen. et sp. nov. a, female entire, dorsal; b, second antenna, anterior; c, first antenna, ventral; d, mandible, posterior; e, first maxilla, posterior; f, second maxilla, posterior; g, maxilliped, anterior; h, anterior of urosome, ventral.

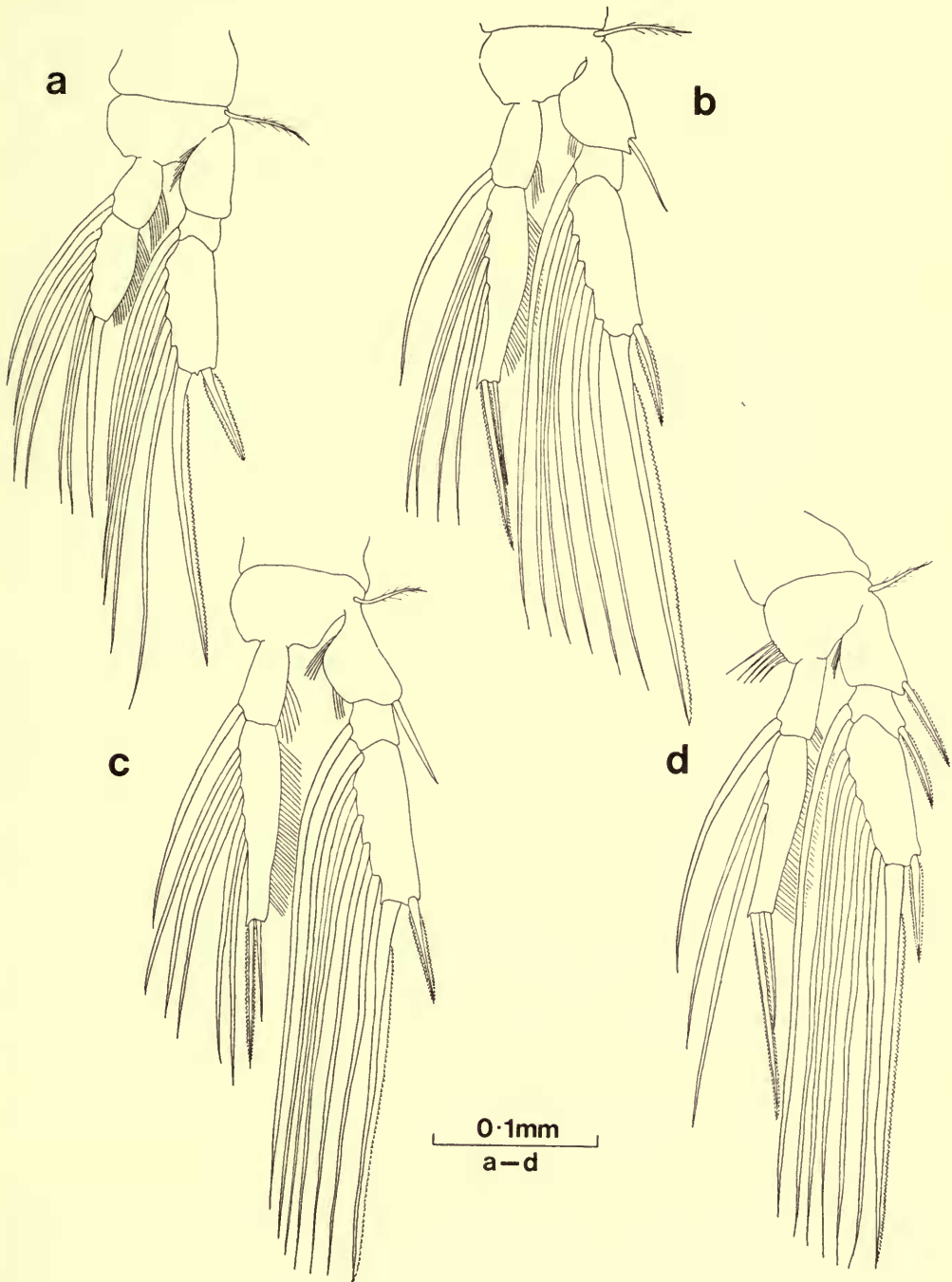


FIG. 2. *Paralubbockia longipedia* gen. et sp. nov. a, leg 1, posterior; b, leg 3, posterior; c, leg 2, posterior; d, leg 4, posterior.

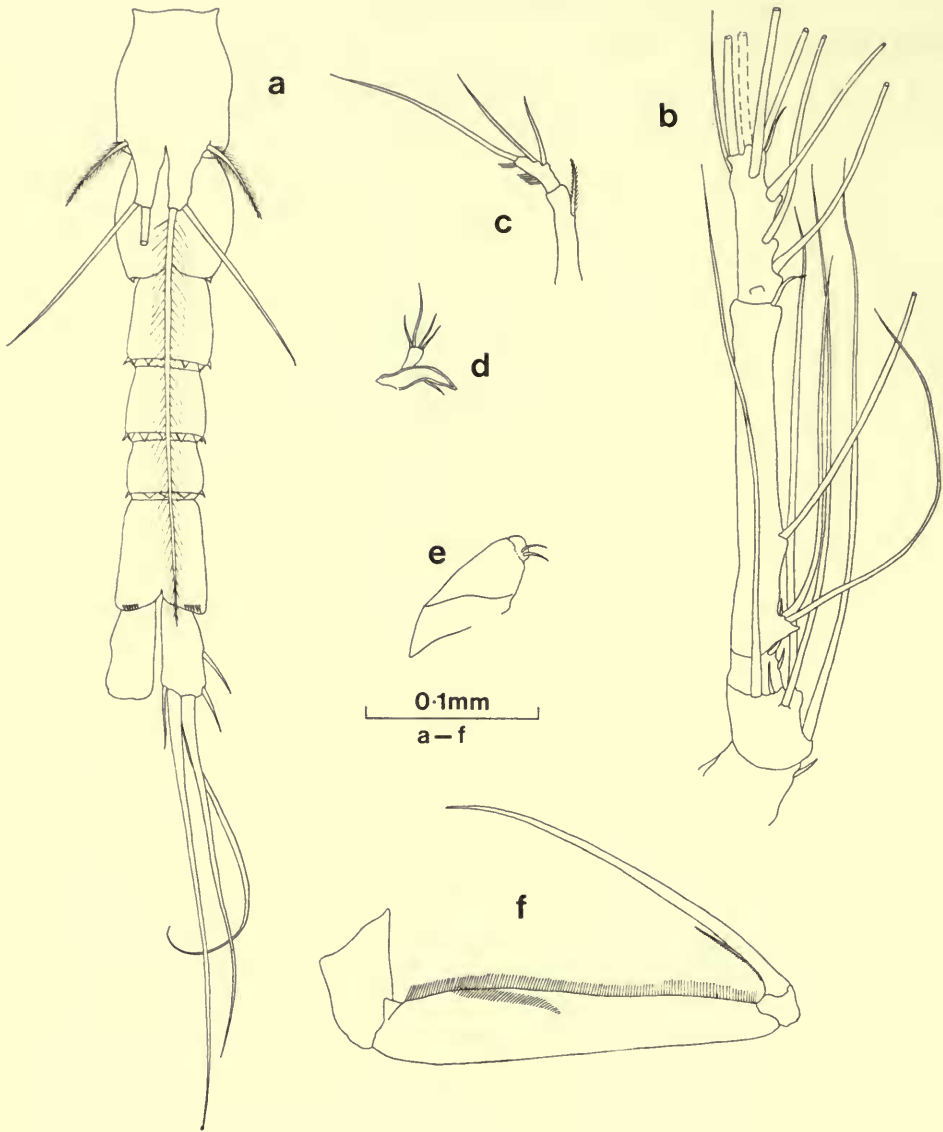


FIG. 3. *Paralubbockia longipedia* gen. et sp. nov. a, male urosome, ventral; b, first antenna, ventral; c, second antenna, posterior; d, first maxilla, posterior; e, second maxilla, posterior; f, maxilliped, anterior.

Second maxilla (Fig. 3e) a squat indistinctly 2-segmented process with 2 small setae on the inner surface of the distal portion.

Maxilliped (Fig. 3f) as in female but less robust and without setae on second segment; spinules on second segment very fine; terminal claw with proximal spinule armed with minute spinules.

Legs 1-4 as in female.

Leg 5 (Fig. 3a) a free segment with a lateral plumose seta near its base and with 2 apical setae; inner apical seta extending posteriorly beyond margin of anal somite, outer seta half length of inner.

Leg 6 probably represented by small cuticularized area with a single spinule, located postero-laterally on genital somite.

Body length of single male specimen 1.19 mm.

MATERIAL EXAMINED. 6 ♀♀ and 1 ♂; holotype ♀ from sample 32, 1 ♀ from samples 8, 9 and 22, and 2 ♀ and 1 ♂ from sample 16. BM(NH) registration numbers: holotype 1976.8, paratype ♂ 1976.9 and paratype ♀♀ 1976.10-13.

REMARKS. Placing *Paralubbockia* in any of the existing families of the Cyclopoida poecilostoma raises certain problems because of the unusual structure of the second antenna and the reduced segmentation of the thoracic legs. However, it has many characters in common with other genera of the family Oncaeidae (general facies, structure of the first antennae, mandibles, maxillae and maxillipeds) and its true relationships appear to lie with this family. It is proposed to place *Paralubbockia* in the Oncaeidae and to emend the familial diagnosis as follows:

ONCAEIDAE Giesbrecht, 1891 emend.

Body cycloform. Prosome 5-segmented, urosome 4- or 5-segmented in ♀ and 5- or 6-segmented in ♂. Caudal ramus with 6 setae. Female apertures usually dorsal, sometimes laterally displaced. First antenna 4- to 8-segmented, never geniculate in males. Second antenna usually 3- or 4-segmented, sometimes 2-segmented. Mandible usually with 4 armature elements, sometimes reduced to an unarmed lash. First maxilla bilobed, each lobe bearing at least 1 seta. Second maxilla 2-segmented with a number of terminal elements. Maxilliped 3- or 4-segmented, with distal segment claw-like in both sexes. Legs 1-4 with 3 segmented exopod and usually 3-segmented endopod, rarely 2-segmented.

In the reduced condition of the second antennae and thoracic legs *Paralubbockia* exhibits advanced characters which are presumably derived from the typical oncaeid condition. The affinities of the new genus appear to lie with the genus *Lubbockia* as incomplete separation of the segments in the rami of the thoracic legs of *Lubbockia* has been reported (Rose, 1933) and the 2-segmented endopod of *Paralubbockia* could have evolved from this condition.

LUBBOCKIA Claus, 1863

DIAGNOSIS. Oncaeidae. Urosome 5-segmented in ♀, 6-segmented in ♂. First antenna 4- to 7-segmented, typically with a long terminal aesthetasc in ♂. Second antenna 3-segmented, terminal segment with about 6 apical elements. Mandible a curved lash with 2 or 3 proximal elements. First maxilla bilobed, outer lobe with 3 setae, inner lobe usually with 2 setae. Second maxilla 2-segmented, distal segment with 3 or 4 apical elements. Maxilliped large with claw-like distal segment.

Legs 1-4 with 3-segmented rami; exopod segment 3 with 2 or 3 external margin spines in legs 1 and 2. Leg 5 a long free segment with 2 apical setae.

TYPE-SPECIES. *Lubbockia squillimana* Claus, 1863.

REMARKS. The genus *Lubbockia* contains 7 described species; *L. squillimana*, *L. aculeata* Giesbrecht, *L. glacialis* Sars, *L. brevis* Farran, *L. minuta* Wolfenden, *L. marukawai* Mori and *L. wilsonae* Heron & Damkaer. The last 3 species are known only from the females. A new species is described below, from both sexes, and the following key will enable all known species to be distinguished.

KEY TO FEMALES OF THE GENUS *Lubbockia*

- | | |
|--|------------------------------|
| 1. 2 spines on external margin of exopod segment 3 of legs 1 and 2 | 4 |
| 3 spines on external margin of exopod segment 3 of legs 1 and 2 | 2 |
| 2. Urosome longer than prosome | <i>L. minuta</i> |
| Urosome shorter than prosome | 3 |
| 3. Endopod segment 3 of leg 4 with 1 inner margin seta | <i>L. glacialis</i> |
| Endopod segment 3 of leg 4 with 2 inner margin setae | <i>L. brevis</i> |
| 4. Maxilliped with large denticles on second segment | 5 |
| Maxilliped without denticles on second segment | <i>L. extenuata</i> sp. nov. |
| 5. First antenna 5-segmented; epimeral plates of fourth thoracic somite not forming a long spiniform process | 6 |
| First antenna 6-segmented; epimeral plates of fourth thoracic somite forming a long spiniform process | 7 |
| 6. Genital complex nearly as long as succeeding somite | <i>L. marukawai</i> |
| Genital complex much longer than succeeding somite | <i>L. squillimana</i> |
| 7. Urosome longer than prosome | <i>L. wilsonae</i> |
| Urosome shorter than prosome | <i>L. aculeata</i> |

KEY TO MALES OF THE GENUS *Lubbockia*

- | | |
|---|------------------------------|
| 1. 3 spines on external margin of exopod segment 3 of legs 1 and 2 | 4 |
| 2 spines on external margin of exopod segment 3 of legs 1 and 2 | 2 |
| 2. Maxilliped claw longer than rest of appendage | <i>L. extenuata</i> sp. nov. |
| Maxilliped claw shorter than rest of appendage | 3 |
| 3. Epimeral plates of fourth thoracic somite rounded; anal somite with conspicuous constriction | <i>L. squillimana</i> |
| Epimeral plates of fourth thoracic somite with spiniform processes; anal somite without conspicuous constrictions | <i>L. aculeata</i> |
| 4. Urosome longer than prosome | <i>L. glacialis</i> |
| Urosome shorter than prosome | <i>L. brevis</i> |

Lubbockia aculeata Giesbrecht, 1891

L. aculeata Giesbrecht 1891 : 477; 1892 : 611, pl. 48, figs 3, 9, 11, 13, 16, 20.

DESCRIPTION. *Female*. Body elongate (Fig. 4a), prosome longer than urosome; postero-lateral angles of fourth thoracic somite drawn out into slender processes; relative lengths of urosome somites and caudal rami 12 : 24 : 17 : 17 : 16 : 14. Posterior margins of abdominal somites provided with dentate hyaline frill (Fig. 4f) and all urosome somites with minute denticles scattered over surface.

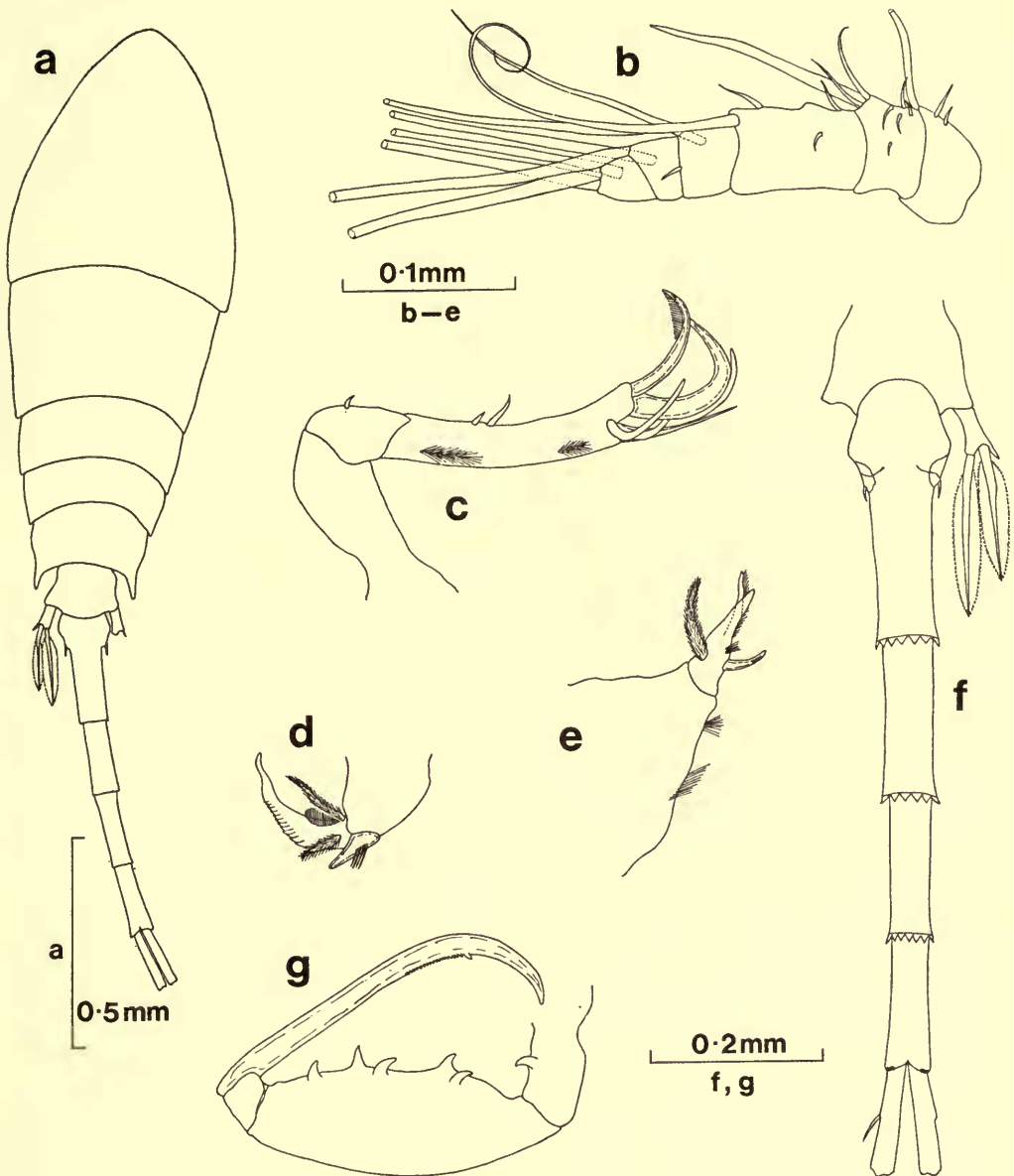


FIG. 4. *Lubbockia aculeata*. a, female entire, dorsal; b, first antenna, ventral; c, second antenna, anterior; d, mandible, anterior; e, second maxilla, posterior; f, urosome, ventral; g, maxilliped, anterior.

First antenna (Fig. 4b) 6-segmented; armature elements per segment I - 3, II - 8, III - 4, IV - 3, V - 2, VI - 5.

Second antenna (Fig. 4c). Second segment with single short spine; elongate terminal segment with an inner curved seta plumose at apex, a stout curved seta and a group of 4 setae on distal margin, 2 setae on inner margin and 2 patches of fine setules near outer margin.

Mandible (Fig. 4d) becoming a curved terminal lash with a denticle row on convex margin, a row of bristles on inner margin, 2 hirsute setae and a robust proximal spine bearing 4 spinules.

First maxilla bilobed; outer lobe with 3, inner lobe with 2 setae.

Second maxilla (Fig. 4e). First segment with 2 patches of setules on outer margin; second segment with inner hirsute seta, outer naked seta and 2 spinulate terminal elements.

Maxilliped (Fig. 4g). Basal segment with 1 inner denticle; second segment with 5 denticles on inner surface; third segment unarmed; terminal segment claw-like with a row of between 18 and 25 small denticles distally on concave margin and a small proximal spinule.

Armature formula of legs 1-4:

	Coxa	Basis	Endopod	Exopod
Leg 1	0-1	1-1	0-1; 0-1; I, I, 4	I-0; I-1; II, I, 4
Leg 2	0-1	1-0	0-1; 0-2; I, II, 3	I-0; I-1; II, I, 5
Leg 3	0-1	1-0	0-1; 0-2; I, II, 2	I-0; I-1; II, I, 5
Leg 4	0-1	1-0	0-1; 0-2; I, II, 1	I-0; I-1; II, I, 5

A single setule row present on outer margin of endopod segments 1-3 and inner margin of exopod segment 1 in all legs.

Leg 5 (Fig. 4f) elongate, produced at outer distal angle into a spinous process; with 2 setae, the longer not extending as far as posterior margin of genital complex.

Leg 6 a flat plate with a single naked setule.

Mean body length of female 2.21 mm, with a range of 2.06-2.35 mm.

Male. Postero-lateral angles of fourth thoracic somite spiniform as in female (Fig. 5a); relative lengths of urosome somites 10:10:16:15:14:17:18.

Appendages as in female except for both first and second antennae and the maxilliped.

First antenna (Fig. 5b) 3-segmented with extremely long terminal aesthetasc.

Second antenna (Fig. 5c). Basal segment unarmed; middle segment with single inner spinule; long terminal segment with 3 curved naked setae apically, a spinulate seta at inner, and 2 naked setae at outer distal angle, 2 patches of fine setules on outer surface and 2 inner margin setae.

Maxilliped (Fig. 5d). Second segment with an irregular row of spinules and a distal tubercle on the inner margin; third segment unarmed; fourth segment claw-like, highly recurved and with a single proximal spinule.

Mean body length of male 2.59 mm, with a range of 2.40-2.74 mm.

MATERIAL EXAMINED. 92 ♀♀, 17 ♂♂ and 21 developmental stages; from samples 3, 11, 12, 16, 17, 19, 20, 22-27, 29 and 31. BM(NH) registration numbers: ♀♀ 1976.14-23, ♂♂ 1976.24-33 and developmental stages 1976.34-43.

REMARKS. The smallest specimen of *L. aculeata* recovered was an immature female with a body length of 1.00 mm (Fig. 5f). The diagnostic characters of the species; the 6-segmented first antennae, the armature of the maxilliped and the

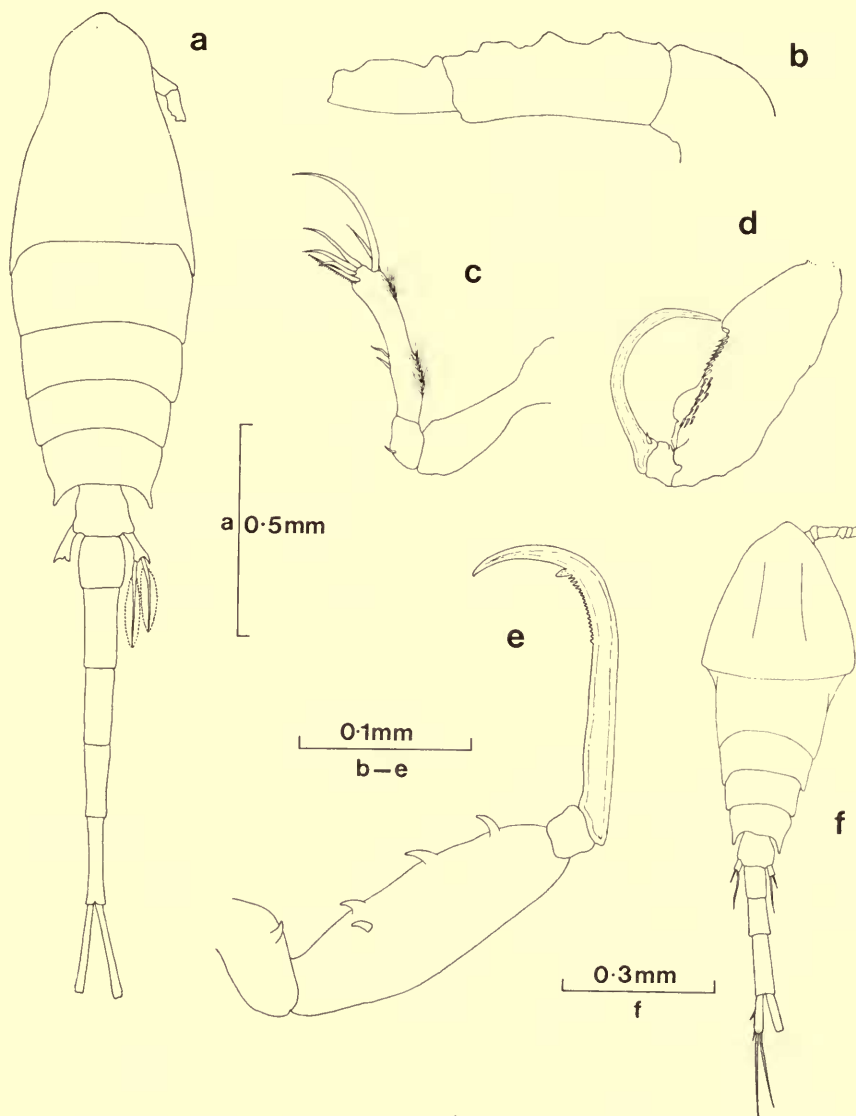


FIG. 5. *Lubbockia aculeata*. a, male entire, dorsal; b, first antenna (segmentation only), ventral; c, second antenna, anterior; d, maxilliped, anterior; e, female copepodite, maxilliped, anterior; f, female copepodite, entire, dorsal.

epimeral plates of the fourth thoracic somite are all distinct at this stage. The armature of the maxilliped (Fig. 5e) is almost identical to that of the adult female with 1 denticle on the basal segment, 4 denticles on the second segment (as compared with 5 in the adult) and a row of 18 small denticles on the concave margin of the claw. The possession of these characters early in development permits the positive identification of juvenile stages.

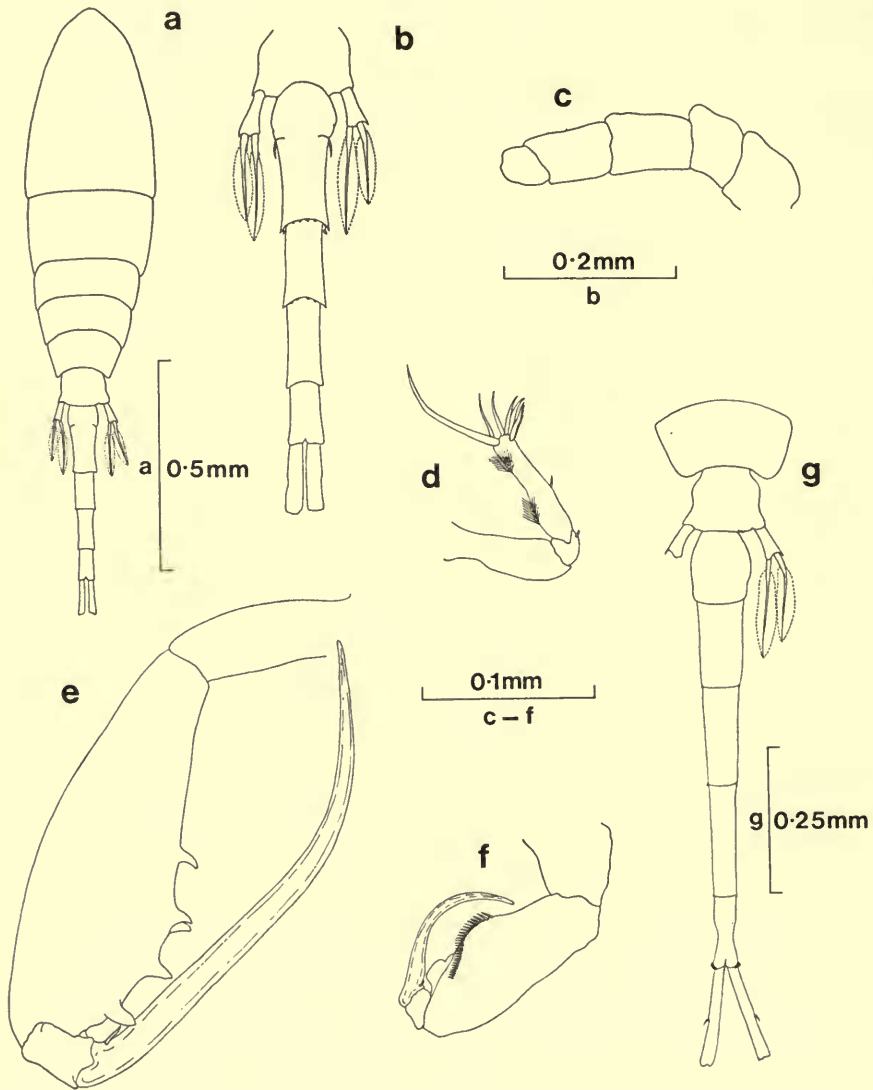


FIG. 6. *Lubbockia squillimana*. a, female entire, dorsal; b, urosome, ventral; c, first antenna (segmentation only), ventral; d, second antenna, anterior; e, maxilliped, anterior; f, male maxilliped, anterior; g, male urosome, ventral.

Lubbockia squillimana Claus, 1863

L. squillimana Claus, 1863: 164, pl. XXV, figs 1-5.

L. squillimana: Giesbrecht, 1892: 611, pl. 48, figs 1, 2, 4-8, 10, 12, 14, 15, 17-19, 21.

DESCRIPTION. *Female*. Body elongate (Fig. 6a); prosome longer than urosome; relative lengths of urosome somites 11:29:16:17:13:14 (Fig. 6b); epimeral plates of fourth thoracic somite not produced posteriorly.

First antenna (Fig. 6c) 5-segmented.

Maxilliped (Fig. 6e). First segment unarmed; second segment with 5 large denticles on inner surface; third segment unarmed; terminal segment claw-like with smooth concave margin and small proximal spinule.

Leg 5 similar in basic structure to that of *L. aculeata* but with the large inner seta extending to beyond the posterior margin of the genital complex.

All other appendages as in *L. aculeata*.

Body length of female ranging from 1.35 to 1.50 mm, with a mean of 1.42 mm.

Male. Prosome longer than urosome; fourth thoracic somite with rounded posterior angles; relative lengths of urosome somites (Fig. 6g) 10:12:14:16:18:13:17. Anal somite with conspicuous constriction in middle of somite.

Second antenna (Fig. 6d) similar to that of *L. aculeata* but with only 1 small spine on inner margin of distal segment.

Maxilliped (Fig. 6f). Unarmed basal segment; second segment with a row of fine spinules and a distal tubercle on the inner margin; third segment unarmed; terminal claw with a proximal spinule.

Body length of single male specimen 2.40 mm.

MATERIAL EXAMINED. 20 ♀♀, 1 ♂ and 8 developmental stages; from samples 12, 14, 19, 20, 22, 26-29 and 31. BM(NH) registration numbers: ♀♀ 1976.44-53, ♂ 1976.54 and developmental stages 1976.55-62.

Lubbockia extenuata sp. nov.

DIAGNOSIS. Body elongate, prosome longer than urosome; epimeral plates of fourth thoracic somite rounded. Caudal rami longer than anal somite and about 5 times longer than broad. First antenna (♀) 6-segmented. First maxilla (♀) with 3 long setae on outer lobe and 2 setae and a spinule on inner lobe. Second maxilla (♀) with 2 rows of fine setules on basal segment. Maxilliped (♀) second segment unarmed; terminal claw with a row of small denticles on concave margin. Maxilliped (♂) second segment with a row of fine spinules; terminal claw longer than rest of appendage. Legs 1-4 armature formula as in *L. aculeata*. Leg 5 with longer inner apical seta not extending to posterior margin of genital complex.

DESCRIPTION. *Female*. Prosome rounded anteriorly and longer than urosome (Fig. 7a); epimeral plates of fourth thoracic somite rounded; relative lengths of urosome somites and caudal ramus 13:31:17:15:12:12. Posterior margins of abdominal somites smooth.

First antenna (Fig. 7b) 6-segmented, with aesthetascs on segments 2, 4 and 6.

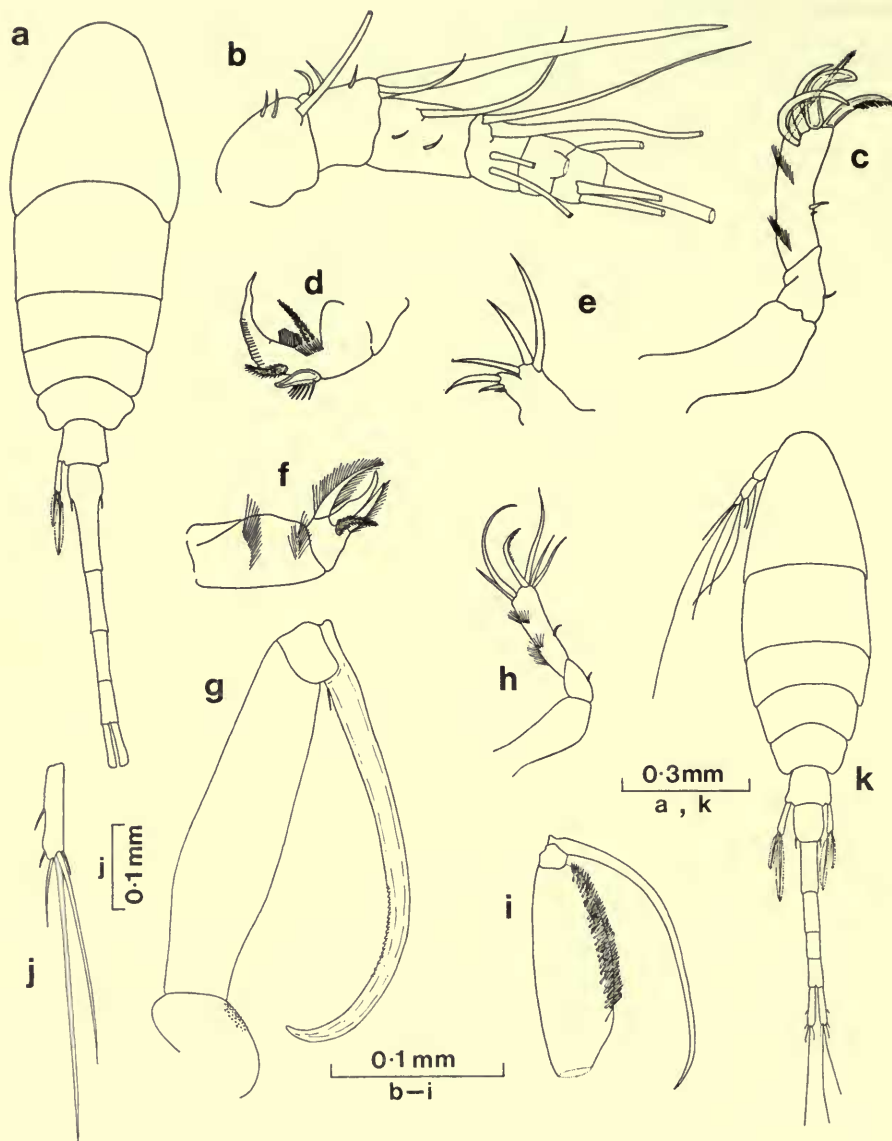


FIG. 7. *Lubbockia extenuata* sp. nov. a, female entire, dorsal; b, first antenna, ventral; c, second antenna, anterior; d, mandible, anterior; e, first maxilla, posterior; f, second maxilla, anterior; g, maxilliped, anterior; h, male second antenna, anterior; i, maxilliped, anterior; j, female caudal ramus, dorsal; k, male entire, dorsal.

Second antenna (Fig. 7c) comprising an unarmed basal segment, middle segment with single spinule and terminal segment with 2 rows of fine setules, 2 spinules on lateral margin and with 6 apical elements; 1 straight seta, 1 curved spinulate seta and 4 curved spines.

Mandible (Fig. 7d) similar to that of *L. aculeata*.

First maxilla (Fig. 7e) with 3 long setae on outer lobe and 2 unequal setae and a small spinule on inner lobe.

Second maxilla (Fig. 7f) segments well defined; basal segment with 2 rows of setules, apical segment with 4 armature elements as in other members of the genus.

Maxilliped (Fig. 7g). First segment with a patch of minute rounded denticles on inner surface; second segment elongate and unarmed; third segment short; terminal claw with a row of 18 small denticles on the concave margin and a proximal spinule.

Legs 1-4 armature as in *L. aculeata*.

Leg 5 with 2 apical setae, the longer inner seta not extending as far as the posterior margin of the genital complex.

Leg 6 represented by a chitinous plate with a single spinule.

Body length of 2 female specimens 1.72 and 1.74 mm.

Male. Prosome longer than urosome (Fig. 7k); epimeral plates of fourth thoracic somite rounded; relative lengths of urosome somites 14 : 15 : 19 : 16 : 11 : 11 : 14. Caudal ramus (Fig. 7j).

First antenna 3-segmented.

Second antenna (Fig. 7h) basal segment unarmed; second segment with inner setule; terminal segment with a long curved seta and a short seta on the distal margin, a curved plumose seta and 3 straight setae on the inner distal margin, a setule on the inner margin and 2 patches of fine setules on the outer surface.

Mandibles, first and second maxillae not dissected.

Maxilliped (Fig. 7i) with unarmed basal segment; second segment with a regularly convex inner margin provided with fine spinules; third segment unarmed; terminal claw longer than rest of appendage and with a very fine serrated membrane along its concave margin.

Legs 1-6 as in the female.

Body length of male 1.34 mm.

MATERIAL EXAMINED. 2 ♀♀ and 1 ♂; the 2 ♀♀ from sample 24 and 1 ♂ from sample 11. BM(NH) registration numbers: holotype ♀ 1976.63, paratype ♂ 1976.64 and paratype ♀ 1976.65.

REMARKS. The new species is closely related to both *L. aculeata* and *L. squillimana* and it possesses a number of characters in common with each of these species. It has, for example, rounded epimeral plates on the fourth thoracic somite, as in *L. squillimana* but the inner seta on leg 5 does not extend as far as the posterior margin of the genital complex, a character exhibited by *L. aculeata*. The most distinctive character of the new species is the reduced armature of the maxilliped. In the female the second segment is unarmed whereas both *L. aculeata* and *L. squillimana* have large denticles on this segment. It was thought possible that the absence of denticles

merely indicated that the specimens were immature and that the denticles were formed late in development but juvenile *L. aculeata* were examined (see p. 114) and found to possess these denticles at an early stage in development. In the absence of denticles on the second maxilliped segment the new species resembles *L. glacialis* but the presence of 3 spines on the external margin of exopod segment 3 in legs 1 and 2 in *L. glacialis* is a significant difference between them.

In the male of the new species the terminal claw of the maxilliped is longer than the rest of the appendage whereas in the species of *Lubbockia* for which the male has been described the terminal claw only just extends as far as the proximal portion of the second segment. The specific name refers to the long slender form of the maxilliped in both sexes of the new species.

Lubbockia glacialis G. O. Sars, 1900

L. glacialis G. O. Sars, 1900 : 114-8, pl. XXXIII.

DESCRIPTION. *Male*. Elongate body with urosome longer than prosome (Fig. 8a); relative lengths of urosome somites 8 : 12 : 16 : 23 : 28 : 4 : 9.

First antenna (Fig. 8b) as described by Heron & Damkaer (1969) but with an additional apical aesthetasc, approximately 7 times longer than the appendage itself.

Second antenna (Fig. 8c) with 6 apical setae; 1 longer than the distal segment, 1 short and hirsute and 4 short and naked; outer margin of distal segment with 1 proximal setule and 2 distal setae.

Mandible damaged in dissection.

First maxilla (Fig. 8d) bilobed with 3 setae on outer lobe and 2 on inner lobe as in other members of the genus.

Second maxilla (Fig. 8e), maxilliped (Fig. 8f) and legs 5 and 6 as described by Heron & Damkaer. Legs 1-4 (Figs 8g, h) as figured by Sars (1900) for the female.

Body length of 2 male specimens 2.08 and 1.91 mm.

MATERIAL EXAMINED. 2 ♂♂; from sample 25. BM(NH) registration numbers : 1976.66-67.

REMARKS. Sars (1900) originally described *L. glacialis* from the female only but the male has recently been described by Heron & Damkaer (1969). As this is the first record of *L. glacialis* outside the North Polar region, except for that of Olson (1949) which Heron & Damkaer regarded as a misidentification of *L. minuta*, the diagnostic characters of the species are figured. Some small differences were observed between the present specimens and those described by Heron & Damkaer (1969). The presence of a normal first maxilla in the present specimens suggests that the anterior mouthparts of Heron & Damkaer's specimen may have been damaged during collection or dissection as were the mandibles of the present specimen. The other differences between the specimens, such as the position of the armature elements on the terminal segment of the second antenna, are not significant and probably result from the difficulty in determining the exact point of insertion of a small seta.

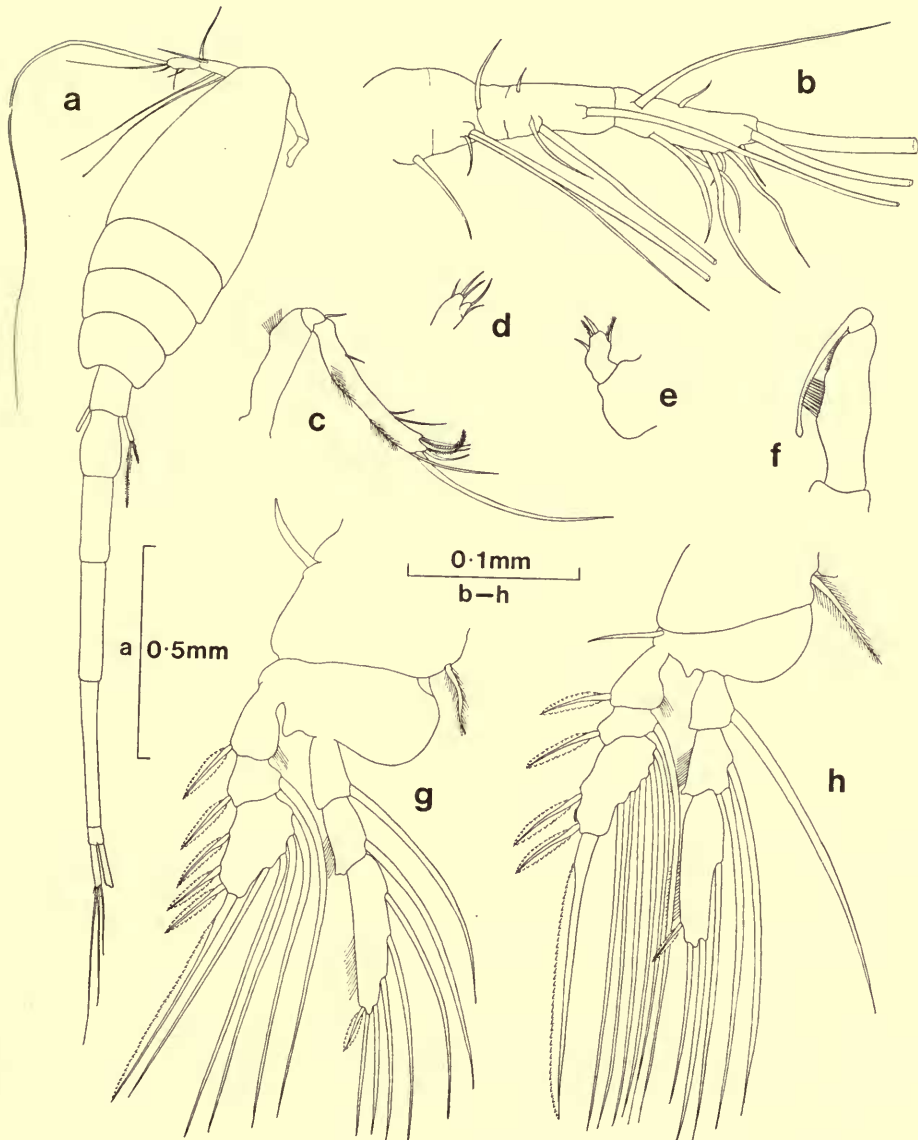


FIG. 8. *Lubbockia glacialis*. a, male entire, dorsal; b, first antenna, ventral; c, second antenna, anterior; d, first maxilla, posterior; e, second maxilla, posterior; f, maxilliped, anterior; g, leg 1, posterior; h, leg 4, posterior.

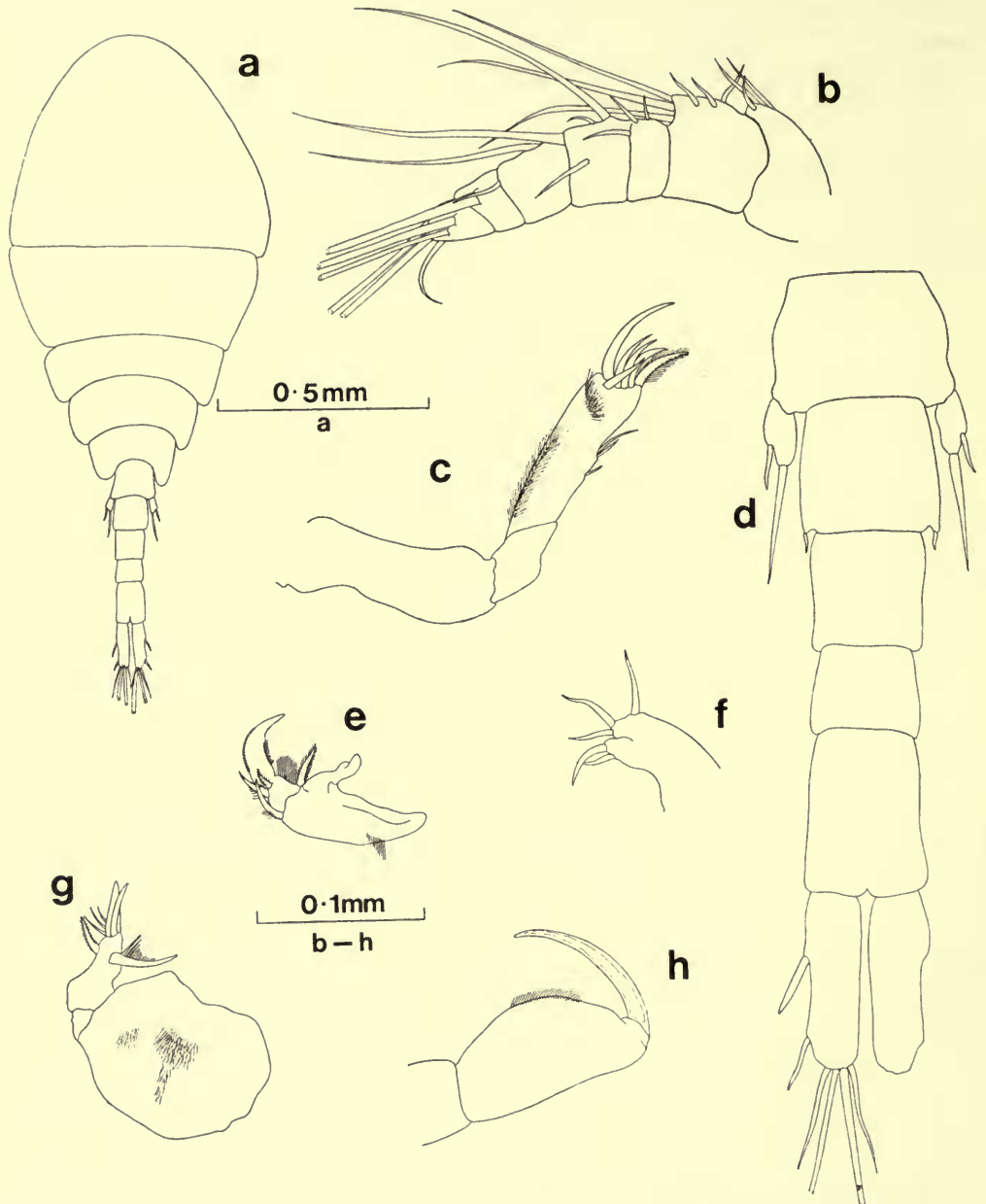


FIG. 9. *Lubbockia brevis*. a, male entire, dorsal; b, first antenna, ventral; c, second antenna, anterior; d, urosome, ventral; e, mandible, anterior; f, first maxilla, posterior; g, second maxilla, anterior; h, maxilliped, anterior.

Lubbockia brevis Farran, 1908

L. brevis Farran, 1908 : 96-7, pl. XI, figs 1-9.

DESCRIPTION. *Male*. Prosome very broad and twice as long as the urosome (Fig. 9a); genital complex short; caudal rami just longer than anal somite.

First antenna (Fig. 9b) 7-segmented; armature elements per segment I - 3, II - 6, III - 3, IV - 4, V - 2, VI - 1, VII - 6.

Second antenna (Fig. 9c) 3-segmented; second segment small, unarmed; third segment with 6 apical elements, a long curved seta, 3 shorter curved spines, 1 straight seta and a small hirsute seta, and with 3 slender setae on the inner margin. Two patches of fine setules present on outer surface of third segment.

Mandible (Fig. 9e) armature comprising a curved apical lash with a row of denticles on the convex margin and a row of fine spinules on the concave margin, 2 hirsute setae lateral to lash, an inner and an outer proximal seta and a row of bristles.

First maxilla (Fig. 9f) bilobed; inner lobe with 2, outer lobe with 3 setae.

Second maxilla (Fig. 9g). Basal segment robust, terminal segment with 2 apical spines, 1 with spinules, and 2 hirsute setae.

Maxilliped (Fig. 9h) 3-segmented; middle segment with a row of fine spinules on inner margin; terminal claw unarmed.

Legs 1-4 (Figs 10a-d) armature formula as follows:

	Coxa	Basis	Endopod	Exopod
Leg 1	0-1	1-1	0-1; 0-1; I, I, 4	I-0; I-1; III, I, 4
Leg 2	0-1	1-0	0-1; 0-2; I, II, 3	I-0; I-1; III, I, 5
Leg 3	0-1	1-0	0-1; 0-2; I, II, I+2	I-0; I-1; II, I, 5
Leg 4	0-1	1-0	0-1; 0-2; I, II, I+1	I-0; I-1; II, I, 5

Apical spine on exopod of legs 2 and 3 about as long as whole exopod, on leg 4 longer than exopod.

Leg 5 (Fig. 9d) a free segment with a long apical seta and a short lateral seta.

Leg 6 represented on genital complex by a short postero-lateral projection with a apical spinule.

Body length of male specimens 1.43 and 1.18 mm.

MATERIAL EXAMINED. 2 ♂♂; from samples 8 and 32. BM(NH) registration numbers: 1976.68-69.

REMARKS. The presence of 3 external spines on exopod segment 3 of legs 1 and 2 is a character exhibited by only 3 species of *Lubbockia*, *L. minuta*, *L. glacialis* and *L. brevis*. These species are closely related but differ in the proportional lengths of prosome and urosome. The male of *L. minuta* is unknown but the urosome is longer than the prosome in female *L. minuta* (Wolfenden, 1905) whereas it is shorter than the prosome in female *L. brevis*. *L. brevis* differs from *L. glacialis* in the possession of 2 setae on the inner margin of endopod segment 3 of leg 4 as compared with a single seta in the latter species. The present specimens are, therefore, referred to *L. brevis* on the basis of their body proportions and leg 4 armature. The relatively short genital complex, the position of leg 6 and the short maxilliped claw suggest

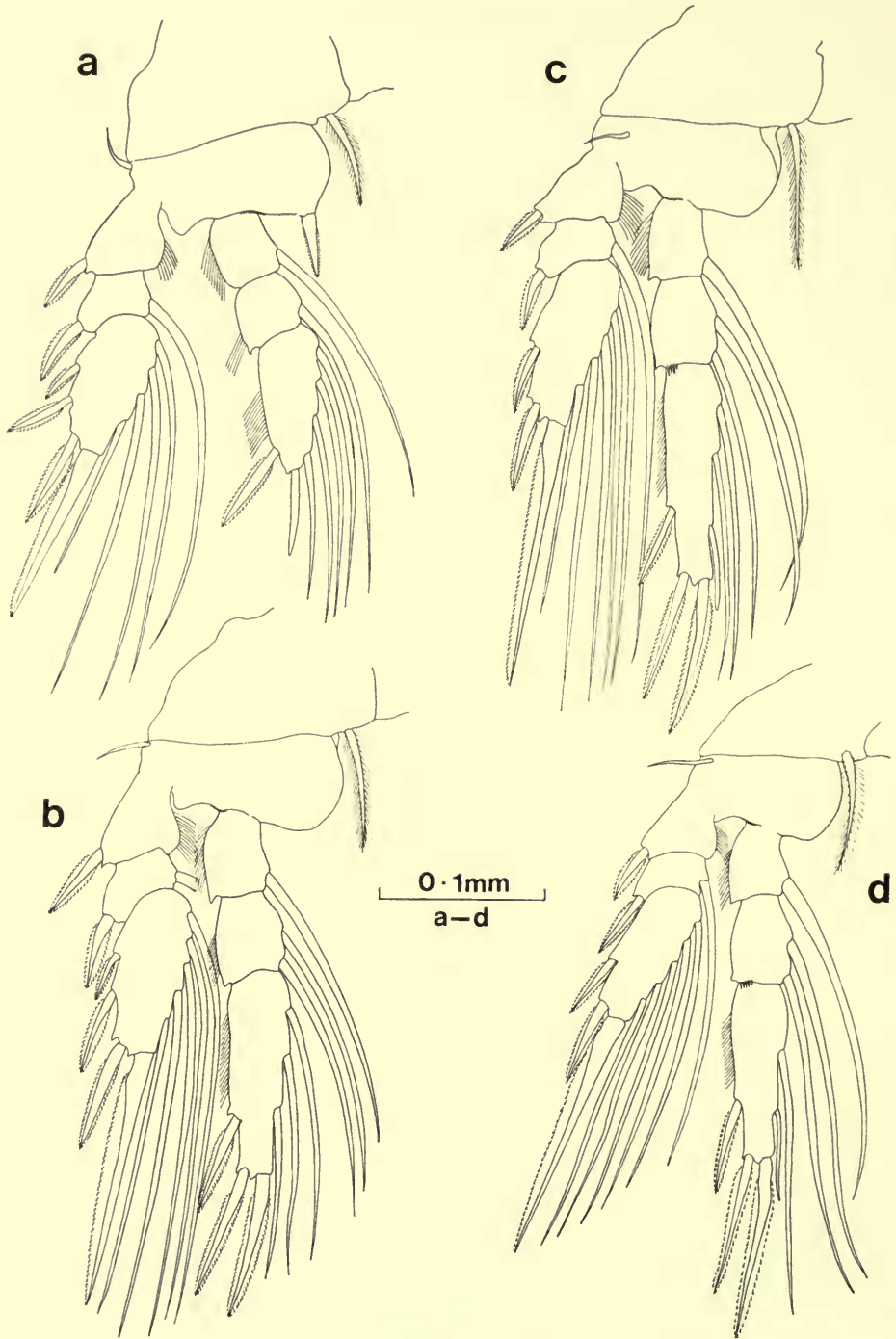


FIG. 10. *Lubbockia brevis*. a, leg 1, posterior; b, leg 2, posterior; c, leg 3, posterior; d, leg 4, posterior.

that these specimens are males and the segmentation of the urosome indicates that they are immature.

L. brevis is uncommon but has a widespread geographical distribution with records from the northeastern Atlantic Ocean (Farran, 1908; present account), the southeastern Pacific Ocean (Bjornberg, 1973) and the northwestern Pacific Ocean (Wilson, 1950).

ONCAEA Philippi, 1843

Oncaea Philippi, 1843: 63.

Antaria Dana, 1846: 229.

DIAGNOSIS. Oncaeidae. Urosome 5-segmented in ♀ and 6-segmented in ♂. First antenna 6-segmented (♀) or 4-segmented (♂) with a long third segment; second antenna 3-segmented usually with a proximal armature group of 4 setae and a distal group of 6 or 7 setae on the terminal segment. Mandible usually with 2 apical blades and 2 hirsute setae. First maxilla bilobed, inner lobe with 3 setae, outer with 4 setae. Second maxilla 2-segmented, distal segment with 3 or 4 elements. Maxilliped 4-segmented, second segment with 2 setae on inner surface, fourth segment claw-like. Legs 1-4 with 3-segmented rami. Leg 5 usually a free segment with 2 apical setae.

TYPE-SPECIES. *Oncaea venusta* Philippi, 1843.

REMARKS. The main characters used to separate the species of *Oncaea* are the proportional lengths of the body somites, the relative dimensions of the caudal rami, the relative lengths of the second and third segments of the second antenna, the armature of the maxilliped and the structure of the fourth thoracic leg. Other characters such as the armature of the terminal segment of the second antenna, of the mandible and of the first maxilla have rarely been used. The proportional lengths of the urosome somites and caudal rami can be affected significantly by fixation which often causes telescoping of the somites and it is important, therefore, to use such measurements only in conjunction with other characters based on the armature of the appendages.

Variation in size and in body proportion is common in species of *Oncaea*. It has been reported for several species; *O. venusta* (Farran, 1929; Sewell, 1947), *O. conifera* Giesbrecht (Farran, 1936; Moulton, 1973), *O. mediterranea* (Claus) (Farran, 1929; Ferrari, 1975) and *O. media* Giesbrecht (Sewell, 1947). Similar variation was encountered in the present material, notably in *O. venusta*, *O. conifera* and *O. ornata* Giesbrecht. It is important that study should be concentrated upon the extent of variation in closely related species especially before the establishment of a new species from a small number of specimens.

During the last decade 14 new species of *Oncaea* have been described: *O. ivlevi* Shmeleva, 1966, *O. prendeli* Shmeleva, 1966, *O. zernovi* Shmeleva, 1966, *O. ovalis* Shmeleva, 1966, *O. atlantica* Shmeleva, 1967, *O. vodjanitskii* Shmeleva, 1969, *O. tregoubovi* Shmeleva, 1969, *O. bathyalis* Shmeleva, 1969, *O. longiseta* Shmeleva, 1969, *O. brodskii* Shmeleva, 1969, *O. longipes* Shmeleva, 1969, *O. minima* Shmeleva, 1969,

O. neobscura Razouls, 1969 and *O. latimana* Gordeyeva, 1975. The discovery of such a large number of new species mostly from well-studied areas is surprising but 10 of these species are less than 0.5 mm in body length and may not have been taken by earlier workers using larger meshed plankton nets. *O. minima* is the smallest species with a body length of 0.18 mm but, from the description (Shmeleva, 1969), it appears to be a mature form. Unfortunately many of the characters of taxonomic importance cannot be discerned from the original descriptions of these species and they are in need of redescription.

Eight species of the genus *Oncaea* were found in the present samples. Four of them, *O. mediterranea*, *O. venusta*, *O. conifera* and *O. media*, are the commonest representatives of the genus and their descriptions are generally limited to diagnostic features. Three species, *O. notopus* Giesbrecht, *O. ornata* and *O. curta* Sars, are less common and are described in detail. The remaining species is new to science.

Oncaea venusta Philippi, 1843

Oncaea venusta Philippi, 1843 : 63, pl. III, fig. 3.

Antaria obtusa Dana, 1852 : 1230, pl. LXXXVI, figs 13a-c.

Oncaea obtusa : Brady, 1883 : 120, pl. LI, figs 1-11.

Oncaea venusta : Giesbrecht, 1892 : 590, pl. II, fig. 5, pl. III, fig. 7, pl. XLVII, figs 5, 13, 19, 39, 44, 48, 50, 54, 58.

DESCRIPTION. *Female*. Prosome vaulted, giving an arched appearance from the lateral aspect (Fig. 11a); prosome provided with minute tubercles regularly distributed over the dorsal and lateral surfaces (Figs 11c, e, f). Genital complex about equal to or slightly longer than rest of urosome. Caudal rami about twice as long as anal somite and 3.2 to 4.5 times longer than broad.

First antenna 6-segmented.

Second antenna with large basal segment bearing a single distal seta; second segment with smooth inner margin and some fine setules near the outer margin; third segment smaller than second, with a proximal group of 4 setae and a distal group of 7 setae.

Mandible with 2 terminal blades, 1 with spinules, and 2 hirsute setae.

First maxilla bilobed, outer lobe with 4 apical setae, inner lobe with 1 lateral and 2 apical setae.

Second maxilla with 2 spinulate terminal elements and a slender subapical seta.

Maxilliped (Fig. 11h). Second segment robust with a spinule row and 2 setae on inner surface, both setae with a single row of spinules; third segment unarmed; terminal claw with a proximal spinule and a spinule row on the concave margin.

Legs 1-4 armature formula as follows :

	Coxa	Basis	Endopod	Exopod
Leg 1	0-0	1-1	0-1; 0-1; 0, I, 5	1-0; 1-1; III, I, 4
Leg 2	0-0	1-0	0-1; 0-2; II, I, 3	1-0; 1-1; III, I, 5
Leg 3	0-0	1-0	0-1; 0-2; II, I, 2	1-0; 1-1; II, I, 5
Leg 4	0-0	1-0	0-1; 0-2; I, II, 1	1-0; 1-1; II, I, 5

Apical spine on exopod segment 3 of all legs shorter than the segment. Exopod segments 1 and 2 with a fine serrated membrane along the external margin in legs 1-4.

Leg 5 (Fig. 11k) a free segment about 1.5 to 1.7 times longer than broad and with 2 apical setae of similar lengths.

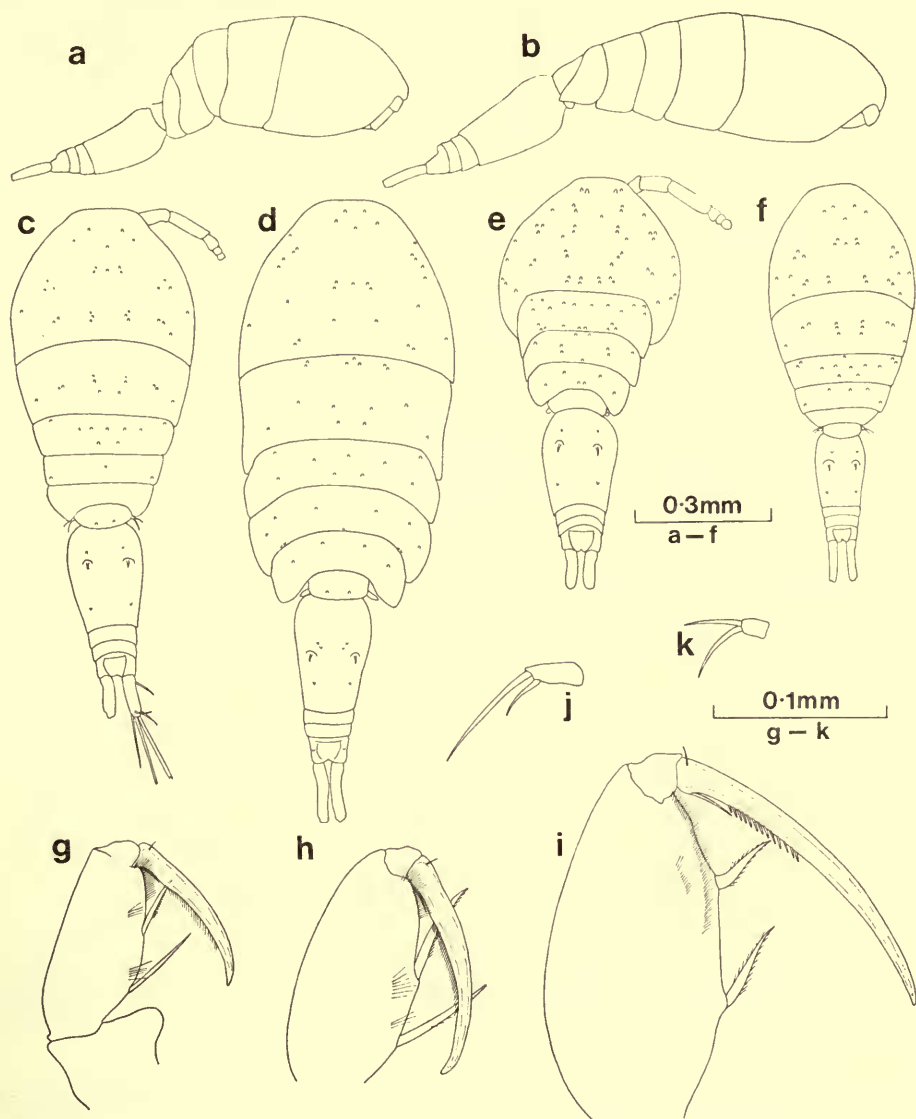


FIG. 11. *Oncaea venusta*. a, female, lateral; c, female form *typica*, dorsal; e, female robust form, dorsal; f, female form *venella*, dorsal; g, maxilliped of robust form, posterior; h, maxilliped of form *typica*; k, leg 5, dorsal. *Oncaea mediterranea*. b, female, lateral; d, female, dorsal; i, maxilliped, posterior; j, leg 5, dorsal.

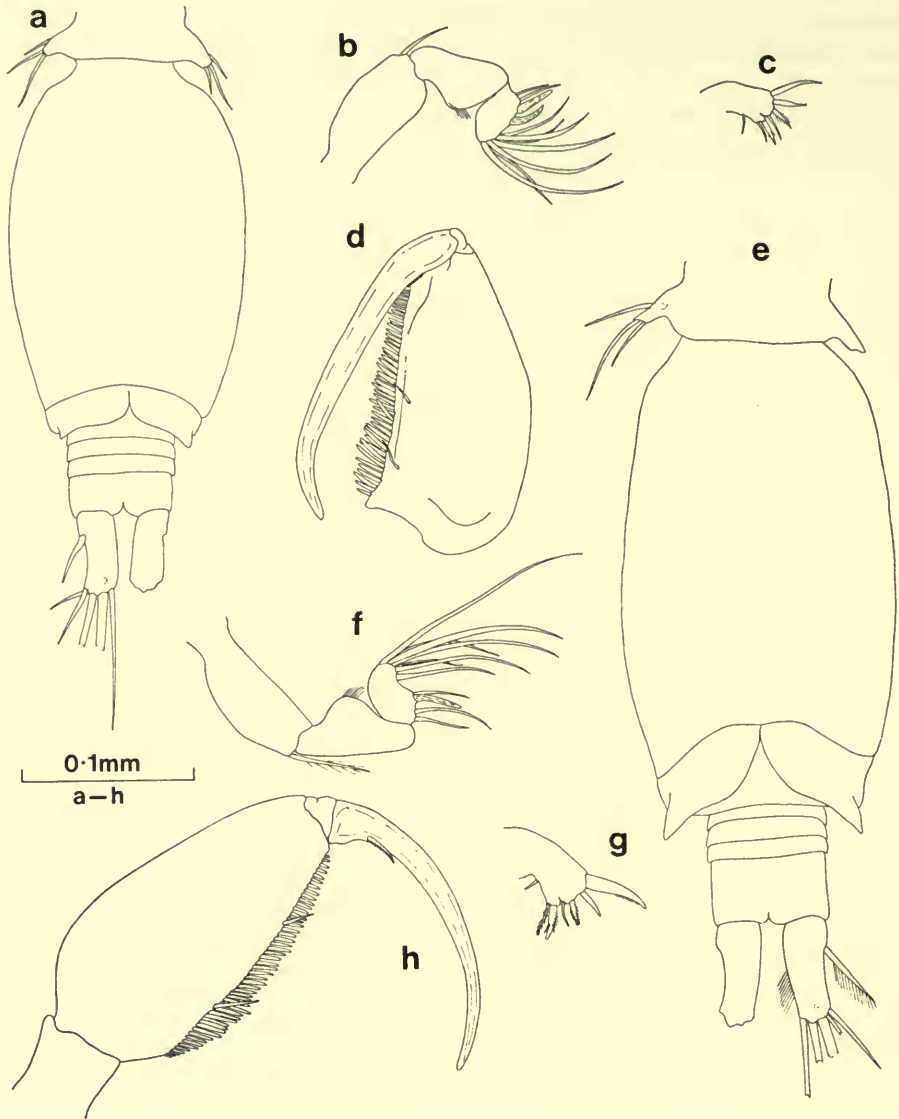


FIG. 12. *Oncaea venusta*. a, male urosome, ventral; b, second antenna, anterior; c, first maxilla, posterior; d, maxilliped, anterior. *Oncaea mediterranea*. e, male urosome, ventral; f, second antenna, anterior; g, first maxilla, posterior; h, maxilliped, anterior.

Male. Genital lappets produced into small postero-lateral processes (Fig. 12a); caudal rami about 1.8 times longer than anal somite and about 2.2 times longer than broad. Appendages as in ♀ except for antennae and maxilliped.

First antenna 4-segmented, with distal segment representing 3 terminal segments of female.

Second antenna (Fig. 12b) with 2 robust spines and 2 setae in proximal armature group on third segment, and with 7 setae in distal group.

First maxilla (Fig. 12c) bilobed; outer lobe with 4 setae, the outermost seta is slender and unarmed; inner lobe with 3 setae.

Maxilliped (Fig. 12d) with single row of large blunt spinules on inner margin of second segment; terminal claw with a proximal spinule, concave margin of claw smooth.

Body length of male ranging from 0.96 to 1.08 mm, with a mean of 1.01 mm.

MATERIAL EXAMINED. 1551 ♀♀ and 32 ♂♂; from samples 3, 4, 5, 8, 9, 11-17, 19, 20 and 22-25. BM(NH) registration numbers: 488 ♀♀ (forma *typica*) 1976.70-79, 1052 ♀♀ (forma *venella*) 1976.80-89, 11 ♀♀ (robust form) 1976.90-99 and 32 ♂♂ 1976.100-109.

REMARKS. Three forms of female *O. venusta* were found in the series of samples, two of which differed only in size (Figs 11c, f) with no other detectable differences. A size frequency analysis of 333 female specimens of *O. venusta* reveals a distinct bimodal pattern with one mode around a length of 0.98 mm and the other around 1.13 mm (Fig. 13). The small form corresponds to *O. venusta* f. *venella* as described by Farran (1929) and the large form corresponds to *O. venusta* f. *typica*. Some individuals intermediate in size between f. *typica* and f. *venella* were recorded. The existence of these two forms of *O. venusta* has been noted by several authors (Farran, 1929 & 1936; Sewell, 1947; Tanaka, 1960; Ferrari, 1975) although the actual range of body length recorded varied with locality. The distribution of the two forms is summarized by Sewell (1947).

The third form of *O. venusta* was present in small numbers in a few of the samples and is referred to as the robust form. It is very squat in general appearance

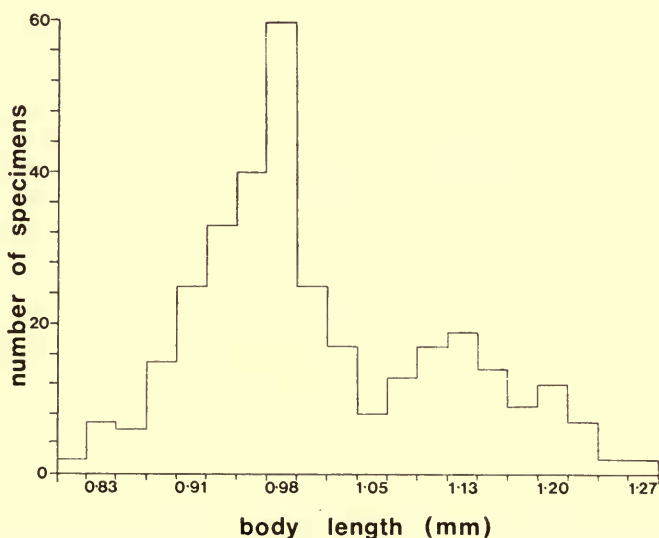


FIG. 13. Frequency distribution of body length in 333 specimens of *Oncaea venusta* taken from samples 19 and 27.

(Fig. 11e) and its exoskeleton is highly sclerotized at the posterior end of the urosome. The appendages are identical to those of f. *typica* (see Fig. 11g for example) but the caudal rami are relatively more slender being about 4.0 to 4.5 times longer than broad. The length of the robust form ranged from 0.88 to 1.40 mm.

Oncaea mediterranea (Claus, 1863)

Antaria mediterranea Claus, 1863 : 159, pl. XXX, figs 1-7.

Oncaea mediterranea : Giesbrecht, 1892 : 591, pl. IV, figs 4, 16, pl. XLVII, figs 8-10 and 47.

DESCRIPTION. *Female*. This species is closely related to *O. venusta* but can be separated from it by the following characters.

Prosoma not strongly vaulted ; body not giving an arched appearance from the lateral aspect (Fig. 11b) ; genital complex about 1.2 times longer than rest of urosome (Fig. 11d) and with sides tapering posteriorly. Caudal rami 2.4 times longer than anal somite and 4.0 to 4.5 times longer than broad.

Maxilliped (Fig. 11i). Setae on second segment both short and hirsute ; terminal claw with a short row of denticles on concave margin.

Leg 5 (Fig. 11j) more elongate than in *O. venusta*, 2.3 to 2.5 times longer than broad and with 1 long apical seta and 1 short subapical seta.

Mean body length of female 1.25 mm, with a range from 0.98 to 1.35 mm.

Male. Genital lappets (Fig. 12e) produced into large postero-lateral points ; caudal rami 1.4 times longer than the anal somite and about 2.8 times longer than broad.

Second antenna (Fig. 12f) with 1 robust seta in the proximal armature group on the terminal segment.

First maxilla (Fig. 12g) with the outermost seta on the outer lobe well developed and bearing a row of fine spinules.

Maxilliped (Fig. 12h) similar to that of male *O. venusta*.

Body length of male ranging from 0.96 to 1.08 mm, with a mean of 1.01 mm.

MATERIAL EXAMINED. 1881 ♀♀ and 138 ♂♂ ; from samples 3-5, 8, 9, 11-17, 19, 20, 22-25, 32 and 34. BM(NH) registration numbers : ♀♀ 1976.110-119 and ♂♂ 1976.120-129.

REMARKS. Only one form of *O. mediterranea* was found in the present sample series although both Farran (1929) and Ferrari (1975) have reported the existence of up to three distinct size groups in this species.

Oncaea rotundata sp. nov.

DIAGNOSIS. Female prosoma rounded anteriorly, twice as long as urosome ; genital complex about as long as rest of urosome ; caudal rami just shorter than anal somite and 2.0 to 2.5 times longer than broad. Second antenna second segment longer than third and with a row of denticles along inner margin. Segment 3 of endopod of leg 4 about equal to or just longer than segments 1 and 2 combined,

swollen proximally and tapering towards apex; inner margin with 1 seta, outer margin unarmed, apex with 2 unequal spines.

DESCRIPTION. *Female*. Prosome 5-segmented, rounded anteriorly and twice as long as urosome (Fig. 14a); genital complex (Fig. 14f) as long as rest of urosome. Caudal rami just shorter than anal somite, about 2.0 to 2.5 times longer than broad and with 6 setae.

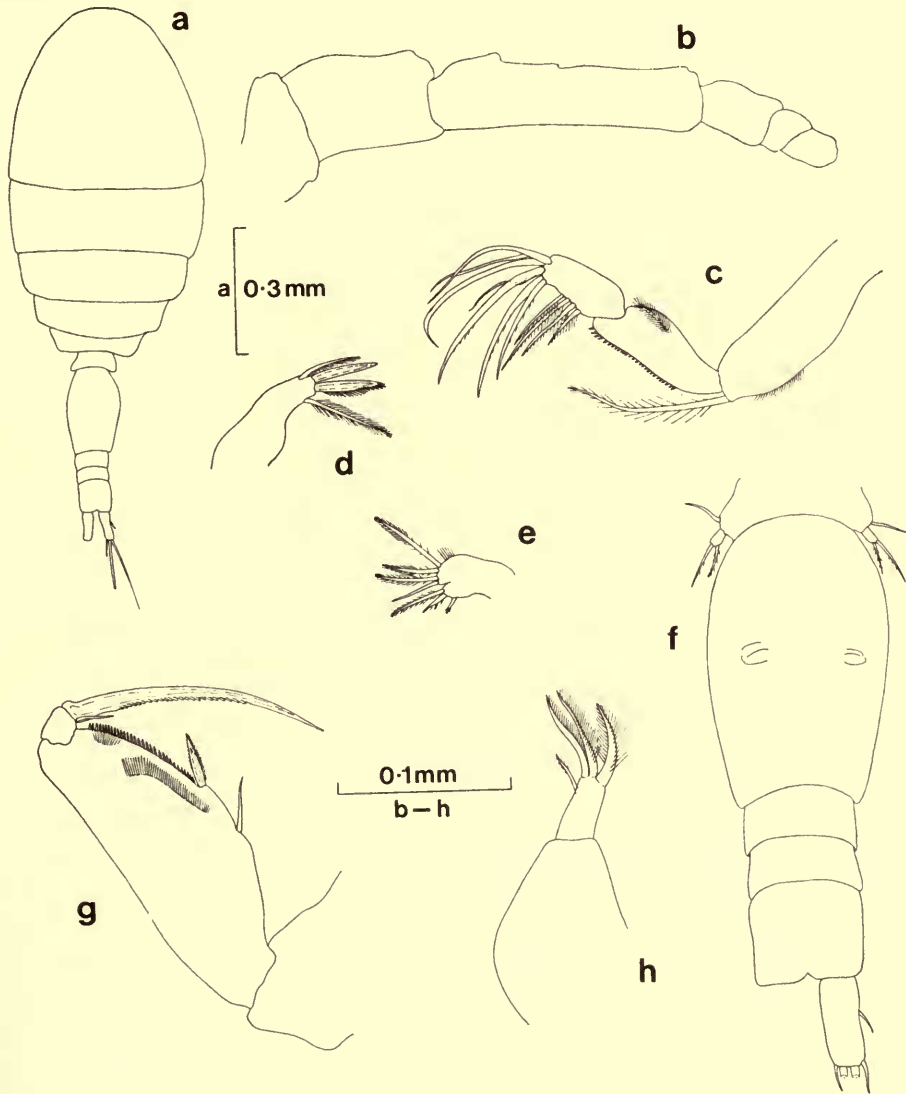


FIG. 14. *Oncaea rotundata* sp. nov. a, female entire, dorsal; b, first antenna (segmentation only), ventral; c, second antenna, anterior; d, mandible, anterior; e, first maxilla, posterior; f, urosome, dorsal; g, maxilliped, anterior; h, second maxilla, posterior.

First antenna (Fig. 14b) 6-segmented, armature elements per segment ; I - 2, II - 5, III - 4, IV - 4, V - 2 and VI - 5.

Second antenna (Fig. 14c). First segment with a long hirsute seta at postero-lateral angle and a fine spinule row on margin proximal to seta ; second segment with a denticle row on inner margin and a spinule row on ventral surface ; third segment shorter than second, with proximal group of 4 hirsute setae and distal group of 7 setae.

Mandible (Fig. 14d) with 2 apical blades, 1 spinulate and 1 naked, a long hirsute seta on the inner margin and an outer spinulate seta.

First maxilla (Fig. 14e) bilobed ; inner lobe with 1 lateral and 2 apical hirsute setae ; outer lobe with 1 unarmed and 3 hirsute setae and a short row of fine spinules.

Second maxilla (Fig. 14h) with 4 spinulate terminal elements.

Maxilliped (Fig. 14g). Robust second segment with 2 spinule rows on inner surface, a proximal naked seta and a distal stout serrate seta ; terminal claw with a short inner spinule and a denticle row along concave margin.

Legs 1-4 (Figs 15a-d). Both rami 3-segmented ; armature formula as follows :

	Coxa	Basis	Endopod	Exopod
Leg 1	0-0	1-1	0-1 ; 0-1 ; 0, I, 5	1-0 ; 1-1 ; III, I, 4
Leg 2	0-0	1-0	0-1 ; 0-2 ; II, I, 3	1-0 ; 1-1 ; III, I, 5
Leg 3	0-0	1-0	0-1 ; 0-2 ; II, I, 2	1-0 ; 1-1 ; II, I, 5
Leg 4	0-0	1-0	0-1 ; 0-2 ; 0, II, 1	1-0 ; 1-1 ; II, I, 5

Apical spine on exopod of all legs externally serrate, internally plumose ; external margin spines serrate ; serrations also present on lateral margins of exopod segments. Rows of setules present on lateral margins of endopod segments and on inner margin of exopod segment 1. Endopod longer than exopod in legs 1-3, shorter than exopod in leg 4 ; endopod segment 3 of leg 4 equal to or just longer than segments 1 and 2 combined, swollen proximally and tapering distally.

Leg 5 (Fig. 14f) with lateral seta and free segment bearing 2 apical setae.

Body length of female specimens 1.27 and 1.05 mm.

MATERIAL EXAMINED. 2 ♀♀ ; holotype from sample 32, paratype from sample 5. BM(NH) registration numbers : holotype ♀ 1976.130 and paratype ♀ 1976.131.

REMARKS. The new species is closely related to *O. obscura* Farran, 1908 but it can be distinguished from *O. obscura* by the structure and armature of leg 4. A spine is present on the lateral margin of endopod segment 3 of leg 4 in *O. obscura* (armature formula of endopod 0-1 ; 0-2 ; I, II, 1) whereas in the new species the lateral margin is unarmed. Endopod segment 3 of leg 4 is about as long as segments 1 and 2 combined whereas in *O. obscura* segment 3 is 1.5 to 2.0 times longer than segments 1 and 2 combined. The shape of endopod segment 3 is different in the two species. The setae of the first maxilla are hirsute and generally longer in the present specimens than in *O. obscura*. Another difference is that the urosome of *O. obscura* is more slender than that of the new species although this may possibly be related to the state of maturity of Farran's specimens which was not given in the original description (Farran, 1908).

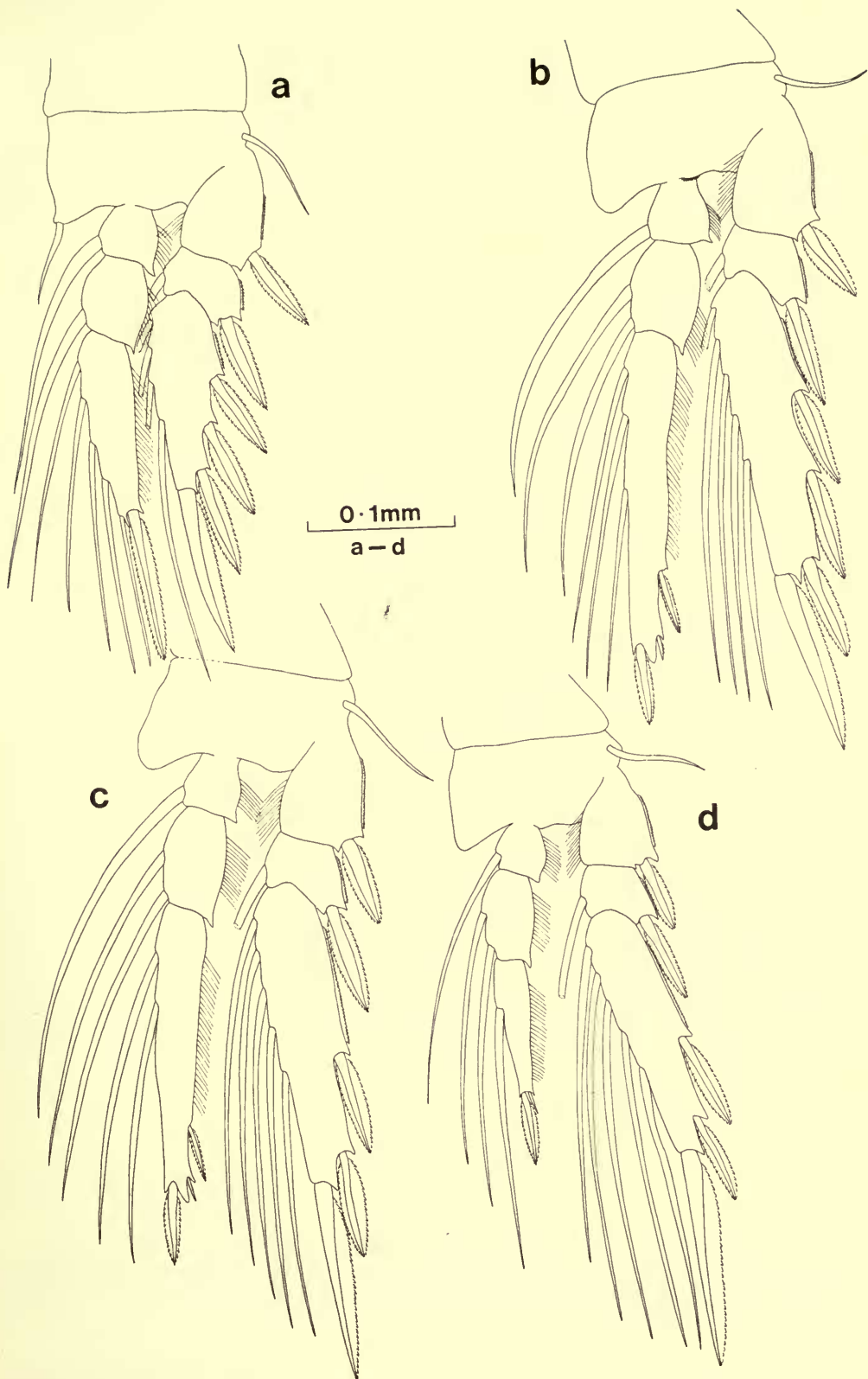


FIG. 15. *Oncaea rotundata* sp. nov. a, leg 1, posterior; b, leg 2, posterior; c, leg 3, posterior; d, leg 4, posterior.

Oncaea notopus Giesbrecht, 1891

Oncaea notopus Giesbrecht, 1891 : 477 ; 1892 : 603, pl. XLVII, figs 12, 15 & 45.

DESCRIPTION. *Female*. Genital complex (Fig. 16a) longer than rest of urosome ; anal somite 1.5 to 1.8 times longer than caudal rami. Caudal rami less than twice as long as broad.

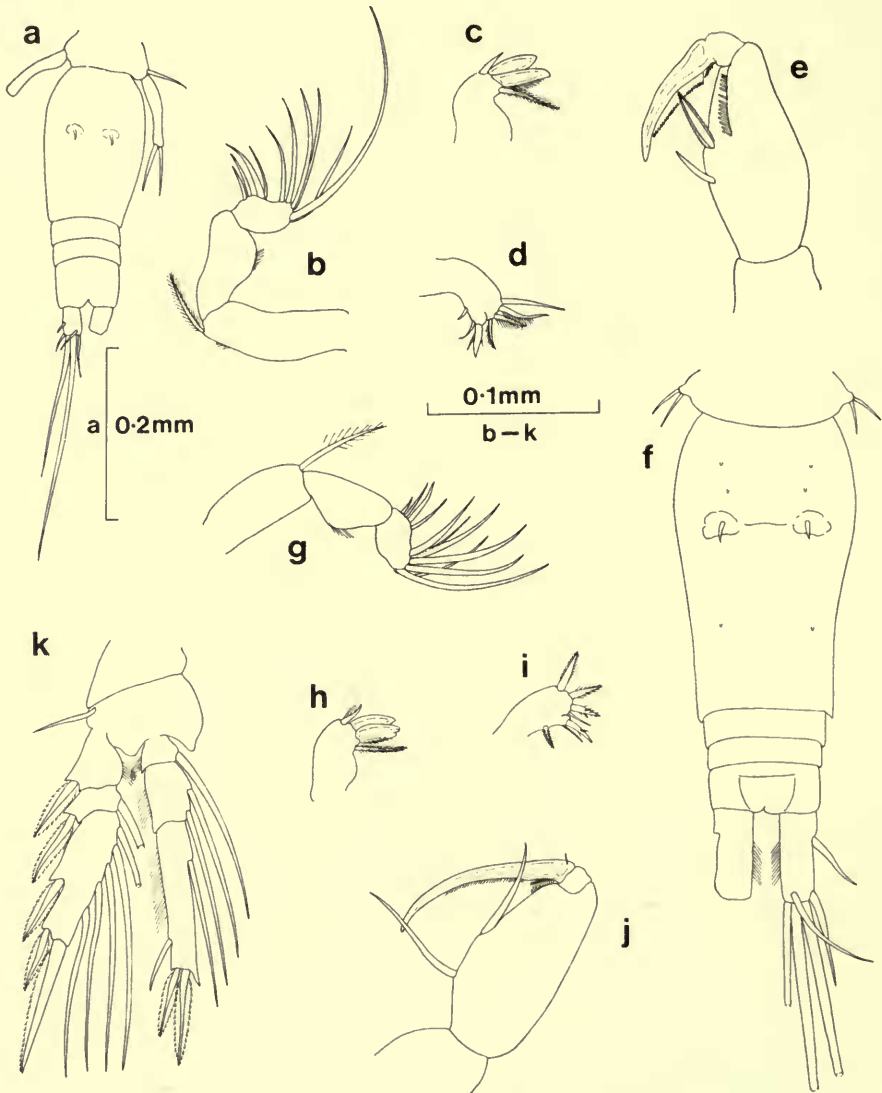


FIG. 16. *Oncaea notopus*. a, female urosome, dorsal ; b, second antenna, anterior ; c, mandible, anterior ; d, first maxilla, posterior ; e, maxilliped, anterior. *Oncaea media*. f, female urosome, dorsal ; g, second antenna, anterior ; h, mandible, anterior ; i, first maxilla, anterior ; j, maxilliped, anterior ; k, leg 4, posterior.

Second segment of second antenna (Fig. 16b) longer than third, with smooth inner margin; third segment with proximal and distal armature groups, with 1 seta of distal group much longer than the others.

Inner blade of mandible (Fig. 16c) simple.

Outer lobe of first maxilla (Fig. 16d) with 1 naked and 3 hirsute setae; inner lobe with a spinulate seta and 2 setules.

Second maxilla with 3 terminal elements.

Maxilliped (Fig. 16e). Second segment with 2 setae situated close together near the middle of the segment, distal seta serrate, proximal seta naked; terminal claw short, stout and armed with a row of denticles along the concave margin and a proximal spinule.

Legs 1-4 armature formula as follows:

	Coxa	Basis	Endopod	Exopod
Leg 1	0 - +	I - I	0 - 1; 0 - 1; 0, I, 5	I - 0; I - 1; III, I, 4
Leg 2	0 - +	I - 0	0 - 1; 0 - 2; II, I, 3	I - 0; I - 1; III, I, 5
Leg 3	0 - +	I - 0	0 - 1; 0 - 2; II, I, 2	I - 0; I - 1; II, I, 5
Leg 4	0 - +	I - 0	0 - 1; 0 - 2; I, II, 1	I - 0; I - 1; II, I, 5

(+ small spinule present.)

Apical seta on exopod segment 3 shorter than the segment in all legs; endopod of leg 4 with apical seta about half as long as segment 3.

Leg 5 (Fig. 16a) free segment elongate, extending posteriorly to level of genital apertures, with 2 apical setae.

Body lengths of the female specimens 1.01 and 0.98 mm.

MATERIAL EXAMINED. 2 ♀♀ from samples 4 and 5. BM(NH) registration numbers: 1976.172 and 1976.173.

REMARKS. This species is readily identifiable on the basis of its elongate leg 5 which extends posteriorly to the level of the genital apertures on the genital complex. Some minor differences in appendage armature were found between the present specimens and those described by Sars (1900). The second antennae of the present specimens possessed 1 long and 5 shorter setae in the distal armature group whereas in Sars' specimens these setae were all about equal in length except for the relatively short apical seta. A spinule row on the second maxilliped segment was noted above and by Giesbrecht (1892) but was not found by Sars (1900).

Oncaea media Giesbrecht, 1891

O. media Giesbrecht, 1891: 477; 1892: 602, pl. II, fig. 12, pl. XLVII, figs 1, 11, 29-33 & 40.
O. curta: Estrada & Genicio, 1970: 30, pl. XII, figs 1-5.

DESCRIPTION. *Female*. Prosome not markedly vaulted; genital complex (Fig. 16f) about 1.5 times longer than rest of urosome. Caudal rami about 1.8 times longer than anal somite and 2.0 to 2.2 times longer than broad.

Second segment of second antenna (Fig. 16g) with smooth inner margin and longer than third segment; distal armature group on third segment comprising 7 setae.

Mandible (Fig. 16h) with tridentate inner blade.

First maxilla (Fig. 16i) with 1 naked and 3 hirsute setae on outer lobe; inner lobe with 1 naked and 1 spinulate apical setae and a hirsute lateral seta.

Maxilliped (Fig. 16j) with 2 very long naked setae and a short distal row of fine spinules on the second segment; terminal claw with a row of spinules along the concave margin.

Legs 1-4 (Fig. 16k) armature formula as in *O. venusta*. Apical setae on exopod segment 3 shorter than the segment in all legs.

Leg 5 (Fig. 16f) a short free segment with 2 similar apical setae.

Mean body length of female 0.81 mm, with a range of 0.78-0.86 mm.

MATERIAL EXAMINED. 58 ♀♀; from samples 3, 5, 9, 11, 13-17, 19, 22-29 and 32-34. BM(NH) registration numbers: 1976.174-183.

REMARKS. *O. media* is a widespread and abundant species and in common with many other species of *Oncaea* it exhibits a considerable degree of variability in the body length of the females (Sewell, 1947; Tanaka, 1960; Ferrari, 1975). On the basis of the range in body length observed the present material would be referable to the major form of Sewell (1947).

O. media and *O. curta* are closely related species and are usually separated primarily on the basis of the proportional lengths of the urosome somites in the females. Recently numerous specimens have been found which possess body proportions intermediate between *O. media* and *O. curta* (Olson, 1949; Estrada & Genicio, 1970; Ferrari, 1975) and some of these have been referred to *O. curta*. The wide range of body form exhibited by female *O. curta* (see p. 143) includes forms that approach typical *O. media* and it is necessary now to reappraise the criteria used to separate these two species. A comparison of the characters of *O. media* and *O. curta* is given in Table 1 using data derived from Giesbrecht (1892), Sars (1916), Sewell (1947), Tanaka (1960), Shmeleva (1969), Estrada & Genicio (1970), Razouls (1974), Ferrari (1975) and the present account.

TABLE 1

A comparison between *Oncaea media* and *O. curta*

	<i>O. media</i>	<i>O. curta</i> †
Length of genital complex :		
length of rest of urosome	1.34-1.63 : 1	1.10-1.30 : 1
Length of caudal rami : length		
of anal somite	1.33-2.00 : 1	1.00-1.43 : 1
Armature of setae on second	setae usually long and	setae usually of moderate
maxilliped segment	naked	length and armed with
		hairs or serrated membrane
Lengths of second and third	third segment markedly	third segment equal to or
segments of second antenna	shorter than second	just shorter than second
Body length	0.55-0.93 mm	0.42-0.75 mm

†See Table 2 for full derivation of these data.

The data presented in Table 1 suggest that although the ranges in the relative lengths of the urosome somites and caudal rami for *O. media* and for *O. curta* overlap it is still possible to use these characters to discriminate between the species as long as others, such as the structure of the second antennae and the armature of the maxilliped, are also considered. On the basis of the criteria established in Table 1 the *O. curta* of Estrada & Genicio (1970) are referred to *O. media*.

Oncaea ornata Giesbrecht, 1891

Oncaea ornata Giesbrecht, 1891 : 477 ; 1892 : 604, pl. XLVII, figs 20, 24, 49 & 53.

DESCRIPTION. *Female*. Form 1. Prosome about 2.1 times longer than urosome (Fig. 17a) ; genital complex about 2.5 times longer than broad and tapering posteriorly into a narrow region about one fifth the length of the complex ; anal somite approximately equal in length to the caudal rami (Fig. 17c).

Second antenna (Fig. 17h) elongate, second segment with a denticulate inner margin ; terminal segment with 1 robust seta in the proximal armature group.

Mandible (Fig. 17e) similar to that of *O. venusta*.

First maxilla (Fig. 17f) with 1 hirsute and 3 naked setae on outer lobe.

Maxilliped (Fig. 17g) large, second segment bearing a spinule row on the inner margin ; distal seta 1.5 times longer than proximal seta and armed with serrate flanges ; terminal claw with row of robust spinules on concave margin increasing in size distally.

Legs 1-4 (Figs 18a, b) armature formula as follows :

	Coxa	Basis	Endopod	Exopod
Leg 1	0 - +	1 - 1	0 - 1 ; 0 - 1 ; 0, I, 5	1 - 0 ; 1 - 1 ; III, I, 4
Leg 2	0 - +	1 - 0	0 - 1 ; 0 - 2 ; I, I, 3	1 - 0 ; 1 - 1 ; III, I, 5
Leg 3	0 - 0	1 - 0	0 - 1 ; 0 - 2 ; I, I, 2	1 - 0 ; 1 - 1 ; II, I, 5
Leg 4	0 - 0	1 - 0	0 - 1 ; 0 - 2 ; I, I, 1	1 - 0 ; 1 - 1 ; II, I, 5

(+ small spinule present (see Fig. 18a).)

Apical spine on exopod much longer than exopod segment 3 in all legs. Apical spine on endopod of legs 2-4 longer than endopod segment 3 ; in leg 1 spine equal to length of segment.

Leg 5 small, with 1 apical seta and 1 lateral seta.

Mean body length of form 1 female 0.99 mm, with a range from 0.91 to 1.05 mm.

Form 2. Similar to form 1 in all characters except : prosome (Fig. 17b) about 1.9 times longer than urosome including the caudal rami ; genital complex (Fig. 17d) oval in outline and without a conspicuous narrow posterior portion.

Maxilliped (Fig. 17i). Distal seta on second segment about 3.5 times longer than proximal seta ; spinules on concave margin of terminal claw not increasing in size distally.

Mean body length of form 2 female 0.86 mm, with a range from 0.76 to 0.93 mm.

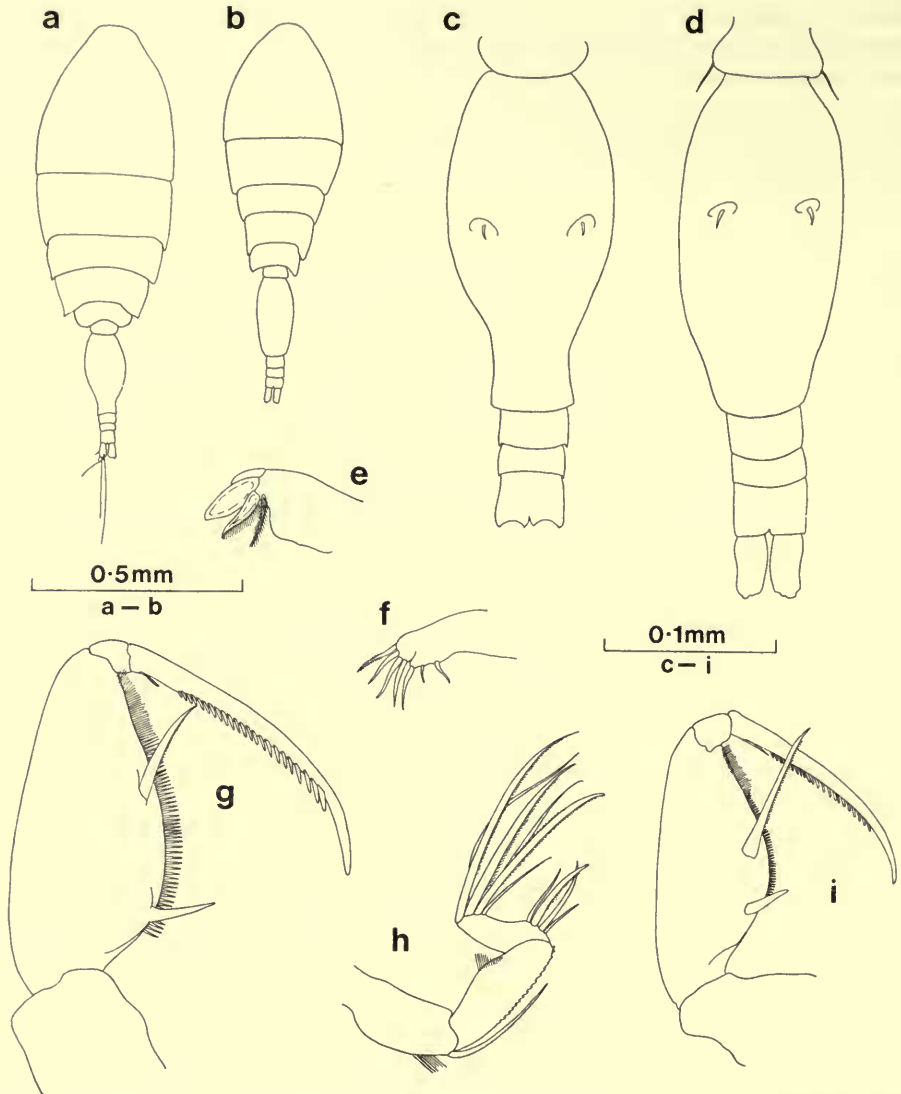


FIG. 17. *Oncaea ornata*. a, female form 1 entire, dorsal; b, female form 2 entire dorsal; c, urosome form 1, dorsal; d, urosome form 2, dorsal; e, mandible, anterior; f, first maxilla, anterior; g, maxilliped form 1, anterior; h, second antenna, anterior; i, maxilliped form 2, anterior.

Male. Form 1. Genital complex elongate, oval in outline (Fig. 18c); genital lappets extending posteriorly, rounded. Caudal rami 1.2 times longer than the anal somite.

Appendages as in the female except for the second antenna and maxilliped. Second antenna (Fig. 18f) with an additional row of spinules on outer margin of

basal segment. Maxilliped (Fig. 18d) with unarmed basal segment; second segment with 2 rows of short blunt spinules on the inner surface and 2 short setae; terminal claw with single proximal spinule.

Mean body length of form 1 male 0.89 mm, with a range from 0.86 to 0.93 mm.

Form 2. Body and appendages as in form 1 except for the maxilliped.

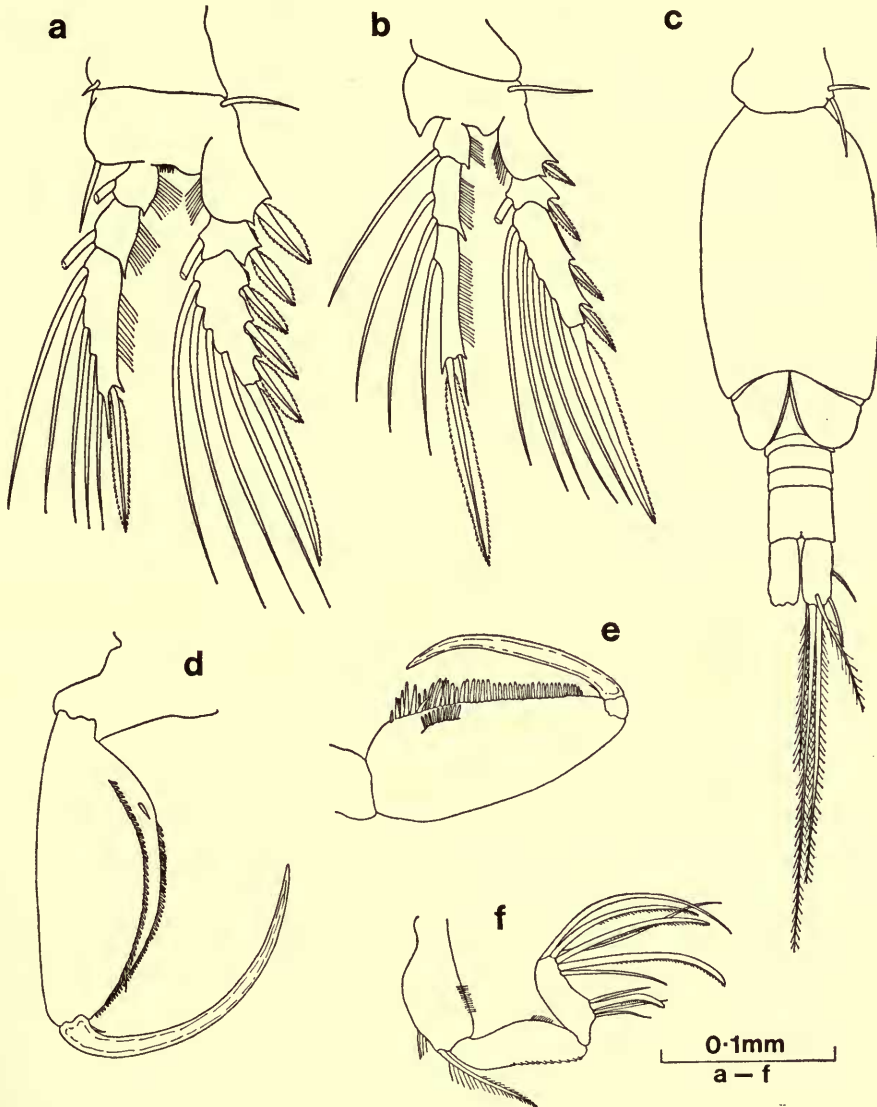


FIG. 18. *Oncaea ornata*. a, female leg 1, posterior; b, leg 4, posterior; c, male urosome, ventral; d, maxilliped form 1, anterior; e, maxilliped form 2, anterior; f, second antenna, anterior.

Maxilliped (Fig. 18e) with unarmed basal segment ; second segment with 1 short row and 1 long row of long blunt spinules on the inner surface ; terminal claw with a single proximal spinule.

Mean body length of form 2 male 0.77 mm, with a range from 0.74 to 0.78 mm.

MATERIAL EXAMINED. 380 ♀♀ and 26 ♂♂ form 1 ; from samples 4, 5, 8, 9, 12-17, 23, 25, 32 & 34. BM(NH) registration numbers : ♀♀ 1976.132-141, ♂♂ 1976.142-151. 467 ♀♀ and 22 ♂♂ form 2 ; from samples 4, 5, 8, 9, 12, 13, 15-17, 22-24, 25, 32 & 34. BM(NH) registration numbers : ♀♀ 1976.152-161 and ♂♂ 1976.162-171.

REMARKS. Two readily distinguishable forms were observed in both sexes of *O. ornata*. The females differed in size, body proportions, in the shape of the genital complex and in maxilliped armature. The males differed only in size and in maxilliped armature. Neither form of the female, however, corresponds exactly to the typical form described by Giesbrecht (1891 & 1892) which appears to exhibit an intermediate condition in certain characters, such as the shape of the genital complex. Although differences between the two forms are present in both sexes the magnitude of these differences is not great enough to justify the separation of the forms into distinct species especially when the variability displayed by other members of the genus is considered.

The male of *O. ornata* has not previously been described to my knowledge but the similarities in appendage structure and armature between the males and the females described above strongly indicate that they are conspecific. Intraspecific variation has rarely been reported for male *Oncaea* except for notes on possible size variation in *O. media* (Sewell, 1947) and in *O. conifera* (Ferrari, 1975) but it is probable that as larger samples of male specimens become available this kind of variation will be recognized more frequently.

Oncaea conifera Giesbrecht, 1891

O. conifera Giesbrecht, 1891 : 477 ; 1892 : 603, pl. XLVII, figs 4, 16, 21, 23, 28, 34-38, 42, 55 & 56.

DESCRIPTION. *Female*. Body form variable ; stocky (Fig. 20a), long (Fig. 20b) and bumped forms present in sample series (using terminology of Moulton (1973)). Bumped form with a dorsal projection on the cephalosome (Fig. 20c). Second thoracic somite of all forms with a conspicuous dorsal projection visible from the lateral aspect (Figs 19a & 20c) ; genital complex (Fig. 19b) 1.3 to 1.5 times longer than the rest of the urosome. Caudal rami about equal to anal somite in length and 2.0 to 2.4 times longer than broad.

Second segment of second antenna with smooth margin in long and stocky forms (Fig. 20d) but with a row of minute denticles in bumped form (Fig. 20e) ; second segment longer than third ; distal armature group on third segment comprising 7 setae.

Inner blade of mandible (Fig. 19e) tridentate.

Outer lobe of first maxilla (Fig. 19f) with 1 hirsute and 3 naked setae.

Maxilliped (Fig. 19d). Second segment with 2 setae and a distal row of fine spinules on the inner surface, distal seta serrate, proximal naked; terminal claw with a proximal spinule and a row of spinules along the concave margin.

Legs 1-4 armature formula as in *O. venusta*. Apical spine on exopod shorter than exopod segment 3 in all legs; third segment of endopod of leg 4 with a conical projection at its apex (Fig. 19c).

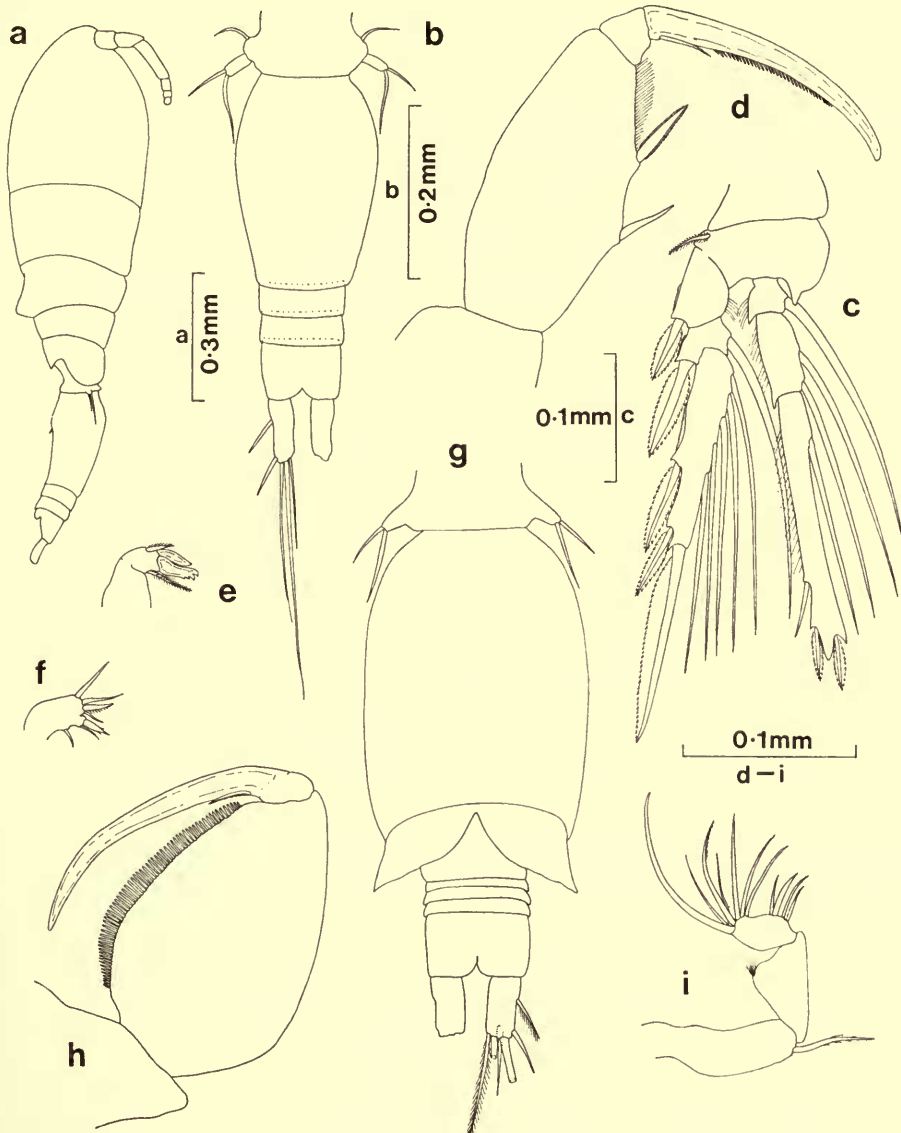


FIG. 19. *Oncaea confiera*. a, female stocky form, lateral; b, urosome, ventral; c, leg 4, posterior; d, maxilliped, anterior; e, mandible, anterior; f, first maxilla, anterior; g, male urosome, ventral; h, maxilliped, posterior; i, second antenna, anterior.

Leg 5 a free segment about 2.5 times longer than broad bearing a long and a short apical seta.

Mean body length of female 1.13 mm, with a range from 0.98 to 1.29 mm.

Male. Genital lappets large and postero-laterally directed; caudal rami shorter than anal somite (Fig. 19g) and about twice as long as broad.

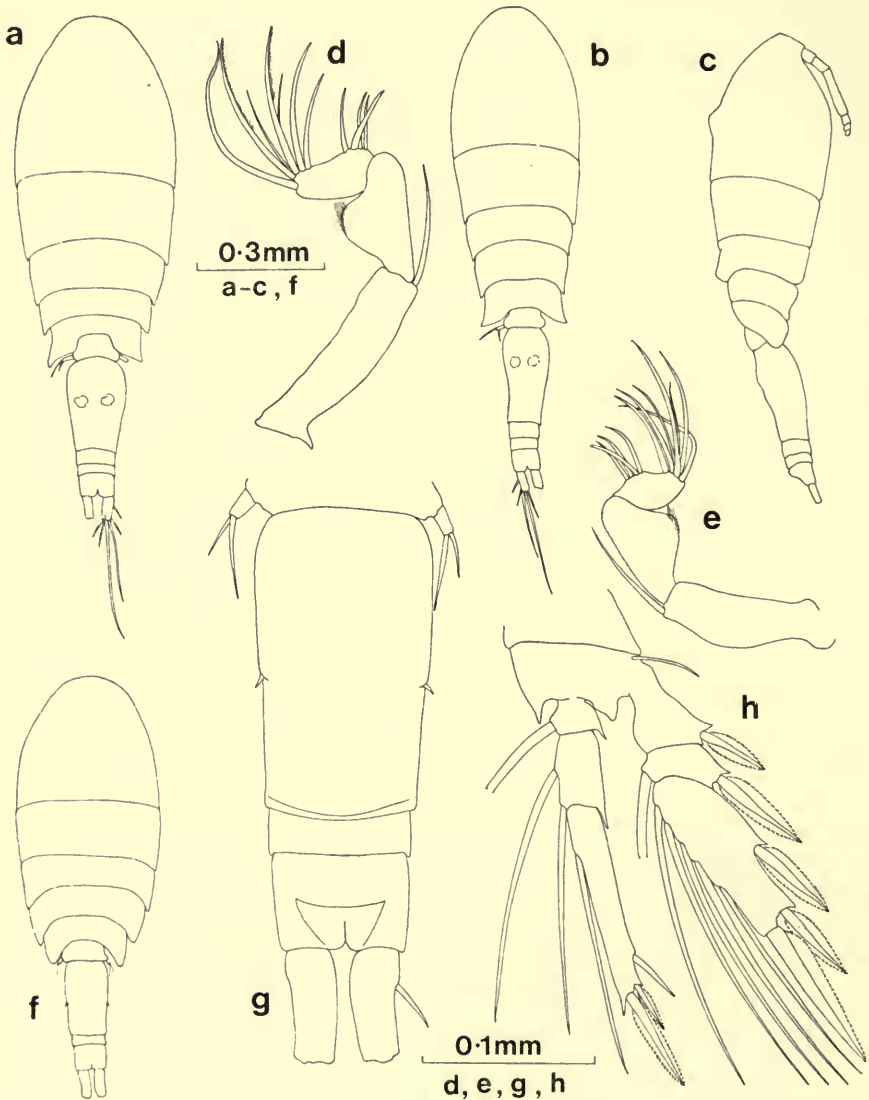


FIG. 20. *Oncaea conifera*. a, female stocky form entire, dorsal; b, long form entire, dorsal; c, bumped form, lateral; d, second antenna stocky form, anterior; e, second antenna bumped form, anterior. *Oncaea* spp. copepodite. f, copepodite entire, dorsal; g, urosome, dorsal; h, leg 4, posterior.

Appendages as in female except for the maxilliped. Second antenna (Fig. 19i).

Maxilliped (Fig. 19h). Second segment with a double row of large blunt spinules and 2 slender setae on inner surface; terminal claw with serrate spinule proximally and with a smooth concave margin.

Mean body length of male 0.82 mm, with a range from 0.76 to 0.88 mm.

MATERIAL EXAMINED. 7031 ♀♀ and 34 ♂♂; from samples 3-5, 8, 9, 11-17, 19, 20, 22-30, 32 & 34. BM(NH) registration numbers: ♀♀ 1976.186-195 and ♂♂ 1976.196-205.

REMARKS. The variability in body form within *O. conifera* has been analysed by Moulton (1973) using principal component analysis. The three forms of female *O. conifera* which were found in the present series of samples are similar to the groups designated stocky, long and bumped by Moulton (1973) and the stocky and long forms also correspond to form *a* and form *b* of Farran (1936) respectively. The taxonomic status of these well-documented forms cannot be determined without data on the sexual isolation of the forms. Such data can only be obtained by direct observation in experimental situations.

Oncaea curta Sars, 1916

O. curta Sars, 1916: 11, pl. IV.

O. ovalis Shmeleva, 1966: 935, pl. 4; 1969: 11, figs 8 & 9.

O. longiseta Shmeleva, 1969: 18, figs 14 & 15.

O. latimana Gordeyeva, 1975: 1397, figs 1-14.

Oncaea sp. 1 Ferrari, 1975: 228, figs 6E, F & 7A-D.

Oncaea sp. 2 Ferrari, 1975: 228, figs 6G, H & 7E-H.

DESCRIPTION. *Female*. Prosome 1.7 to 1.9 times longer than urosome (Fig. 21a); genital complex 1.2 to 1.3 times longer than rest of urosome (Fig. 21c); caudal rami about equal to or 1.1 times longer than anal somite.

First antenna 6-segmented, segmental armature elements; segment I - 2, II - 7, III - 4, IV - 2, V - 2, VI - 5.

Second antenna (Fig. 21b). First segment with distal outer seta; second segment with a short row of setules near the lateral margin; third segment just shorter than second and bearing a proximal group of 4 setae and a distal group comprising 1 long hirsute seta and 5 shorter naked setae.

Mandible (Fig. 21d) with tridentate inner apical blade.

First maxilla (Fig. 21e) bilobed; outer lobe with 4 naked setae; inner lobe with 1 spinulate seta and 1 naked seta apically and a hirsute seta laterally.

Second maxilla (Fig. 21f) with 3 apical elements; a strong spine with a row of large spinules, a small plumose seta and a slender outer seta.

Maxilliped (Fig. 21g). Second segment robust with a row of fine spinules along the inner margin and 2 setae, the proximal naked and the distal hirsute; terminal claw with a row of spinules along proximal portion of concave margin, spinules increasing in size distally.

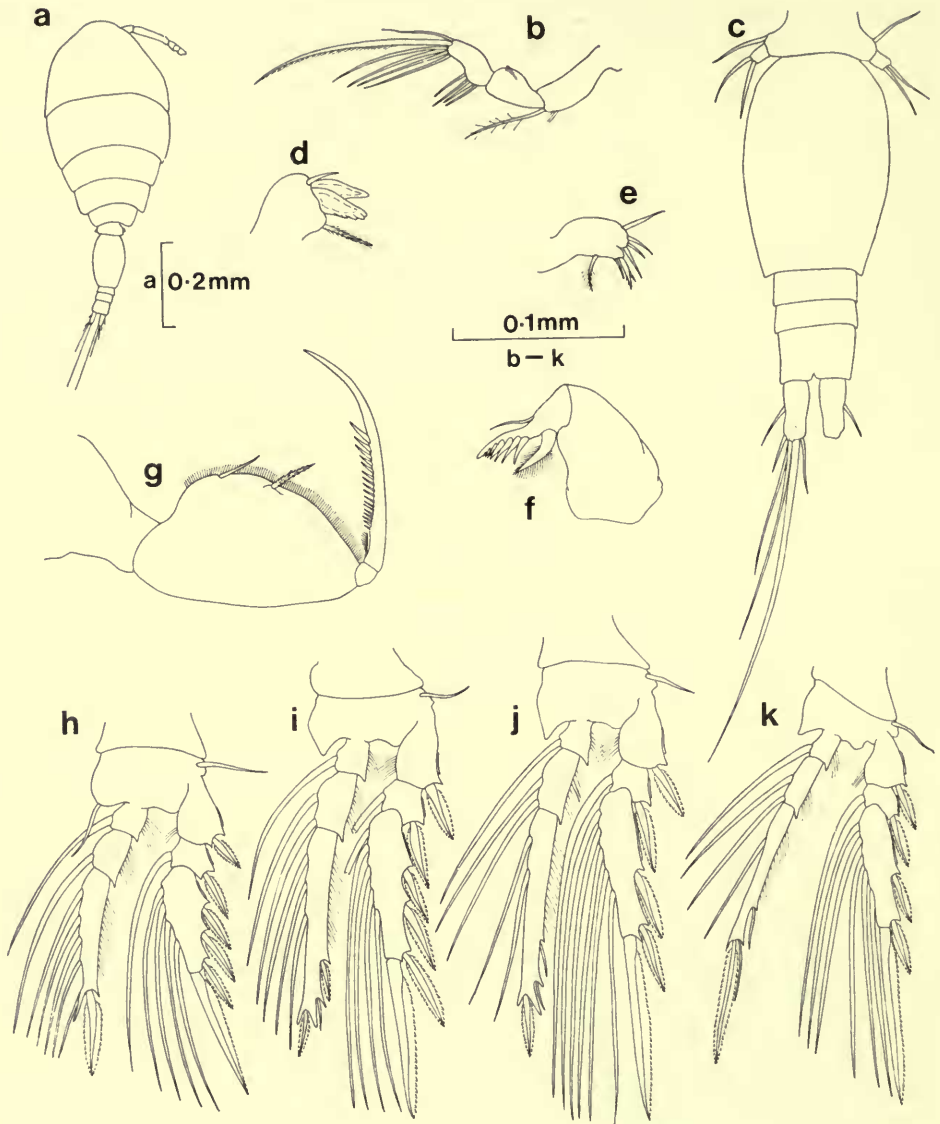


FIG. 21. *Oncaea curta*. a, female entire, dorsal; b, second antenna, anterior; c, urosome, ventral; d, mandible, anterior; e, first maxilla, posterior; f, second maxilla, anterior; g, maxilliped, anterior; h, leg 1; i, leg 2, posterior; j, leg 3, posterior; k, leg 4, posterior.

Legs 1-4 (Figs 21h-k) armature formula as follows :

	Coxa	Basis	Endopod	Exopod
Leg 1	0-0	1-1	0-1; 0-1; 0, I, 5	1-0; 1-1; III, I, 4
Leg 2	0-0	1-0	0-1; 0-2; II, I, 3	1-0; 1-1; III, I, 5
Leg 3	0-0	1-0	0-1; 0-2; II, I, 2	1-0; 1-1; II, I, 5
Leg 4	0-0	1-0	0-1; 0-2; II, I, 1	1-0; 1-1; II, I, 5

Endopod longer than exopod in all legs; digitiform projections present on endopod segment 3 of legs 1-3 on both sides of apical spine and proximal to both lateral spines on legs 2-4. Terminal spine of exopod longer than exopod segment 3 in all legs; inner apical spine on endopod of leg 4 approximately twice as long outer and 0.8 times as long as endopod segment 3.

Leg 5 (Fig. 21c) a free segment with 2 equal apical setae.

Body length of female specimens 0.73 and 0.71 mm.

MATERIAL EXAMINED. 2 ♀♀; from samples 16 and 24. BM(NH) registration numbers: 1976.184 and 1976.185.

REMARKS. Within the genus *Oncaea* there exists a readily distinguishable group of described species all closely related to *O. curta*. This group comprises *O. curta*, *O. ovalis*, *O. longiseta*, *O. latimana* and *Oncaea* sp. 1 and 2 of Ferrari (1975). A comparison of the diagnostic characters of these species and of the material described above as *O. curta* is given in Table 2. Intraspecific variation in size and body proportions is common in species of *Oncaea* and is well documented (see p. 123). The variation in the proportional lengths of the body regions and the overlap in these measurements between the species of the *O. curta* group indicate that these characters cannot be used to separate species within the group. The details of appendage armature given in Table 2 have been taken from the original descriptions and figures but many important characters are either not given or are figured too poorly to be used. The small differences in appendage armature between these species are not sufficient to justify their separation especially when some of the characters are extremely difficult to observe, for example, the presence or absence of serrations on the small subapical spines on the endopod of leg 4. It is proposed therefore to regard *O. ovalis*, *O. longiseta*, *O. latimana* and *Oncaea* sp. 1 and 2 of Ferrari (1975) as junior subjective synonyms of *O. curta*.

O. curta is variable in body proportions, size and, to a smaller extent, in the armature of its appendages and in order to define the limits of this variability it will be necessary to describe all the appendages in detail in any future work. It would then be possible to assess the taxonomic significance of minute differences in armature, such as the presence of a single long hirsute seta in the distal armature group at the apex of the second antenna in the form described by Shmeleva (1969) as *O. longiseta* and in the present material. The existence of intraspecific variation in the armature of the second antenna in a well-defined species, such as *O. notopus*, suggests however that differences of this nature may not be significant.

The differences between *O. curta* and *O. media* have already been discussed (see p. 134).

TABLE 2

Variability within the species *O. curta*

	<i>O. curta</i> (Sars, 1916)	<i>O. latimana</i> (Gordeyeva, 1975)	<i>Oncaea</i> sp. 1 † (Ferrari, 1975)	<i>O. longiseta</i> (Shmeleva, 1969)	<i>O. ovalis</i> (Shmeleva, 1969)	Present material
Body length (mm)	0.66	0.50	0.68-0.71	0.54-0.58	0.72-0.75	0.71-0.73
Length genital complex : rest of urosome	1 : 1	1 : 14 : 1	1 : 36 : 1	1 : 29 : 1	1 : 17 : 1	1 : 2-1.3 : 1
Length anal somite : caudal rami	1 : 1.43	1 : 1	1 : 2.12	1 : 1.40	1 : 1	1 : 1.0-1.1
Segments 2 and 3 of second antenna	seg. 3 shorter	seg. 3 shorter	seg. 3 shorter	seg. 3 shorter	seg. 2 and 3 equal	seg. 3 just shorter
Spinules on inner margin of second segment of maxilliped	short distal row	long row	short distal row	short distal row	long row	long row
Distal seta on maxilliped segment 2	hirsute	hirsute	1 row hairs	1 row hairs	dentate	hirsute
Proximal seta on maxilliped segment 2	?	hirsute	1 row hairs	1 row hairs	dentate	naked
Armature of claw	?	large spinules	large spinules	small spinules	large spinules	large spinules

†The body proportions of this taxon do not fall within the normal range of *O. curta* and it has been regarded as an aberrant form and omitted from Table 1.

Oncaea sp.

Many immature female specimens belonging to the genus *Oncaea* were recovered from the samples. These specimens, which were not identified to the specific level, can be recognized as developmental stages by the possession of a 4-segmented urosome (Fig. 20f). Only 1 somite is present between the genital complex and the anal somite as compared with 2 somites in mature forms. Another juvenile character is the lateral position on the genital complex of the chitinous plates and spinules which mark the position of the genital apertures in the adult (Fig. 20g). The apertures are dorsally situated in the mature females. The appendages of the same individual (as illustrated in Figs 20f, g) are almost indistinguishable from those of the adult. Leg 4, for example, displays normal adult segmentation and possesses a full complement of armature elements (see Fig. 20h).

MATERIAL EXAMINED. 68 specimens; from samples 4, 5, 9, 11-13, 15, 16, 23, 24, 27 & 29. BM(NH) registration numbers: 1976.229-238.

CONAEA Giesbrecht, 1891

DIAGNOSIS. Oncaeidae. Urosome 5 (♀) or 6 (♂) segmented. First antenna 6-segmented in ♀, 4-segmented in ♂. Second antenna 3-segmented; third segment with a single proximal seta and a distal group of 4 setae. First maxilla bilobed, both lobes with 3 setae. Maxilliped 4-segmented, with distal segment claw-like; second segment with 2 inner setae. Legs 1-4 with 3-segmented rami, armature formula:

	Coxa	Basis	Endopod	Exopod
Leg 1	0-0	1-1	0-1; 0-1; 0, I, 5	1-0; 1-1; III, I, 4
Leg 2	0-0	1-0	0-1; 0-2; 0, I, 3	1-0; 1-1; II, I, 5
Leg 3	0-0	1-0	0-1; 0-2; 0, I, 2	1-0; 1-1; II, I, 5
Leg 4	0-0	1-0	0-1; 0-2; 0, I, 1	1-0; 0-1; I, I, 5

Leg 5 reduced to a single seta.

TYPE-SPECIES. *Conaea gracilis* (Dana, 1852).

REMARKS. This genus is very closely related to *Oncaea*. The characters that distinguish between these two genera are the armature of the second antennae and the armature of legs 1-4. The transformation of the armature elements of both armature groups on the third segment of the second antenna in *Conaea* is a character not exhibited by any species of *Oncaea*, similarly the armature of the exopods of legs 1-4 of *Conaea* is a feature unique to this genus.

Conaea gracilis (Dana, 1852)

Antaria gracilis Dana, 1852: 1229, pl. 86, fig. 11a-d.

Conaea rapax Giesbrecht, 1891: 477; 1892: 605-6, pl. 48, figs 50-59.

Oncaea gracilis: T. Scott, 1894: 116-7, pl. XIII, figs 4-12.

DESCRIPTION. *Female*. Prosome about 1.6 times longer than urosome (Fig. 22a); genital complex about as long as rest of urosome including caudal rami. Caudal rami 1.1 to 1.2 times longer than anal somite and 1.6 times longer than broad.

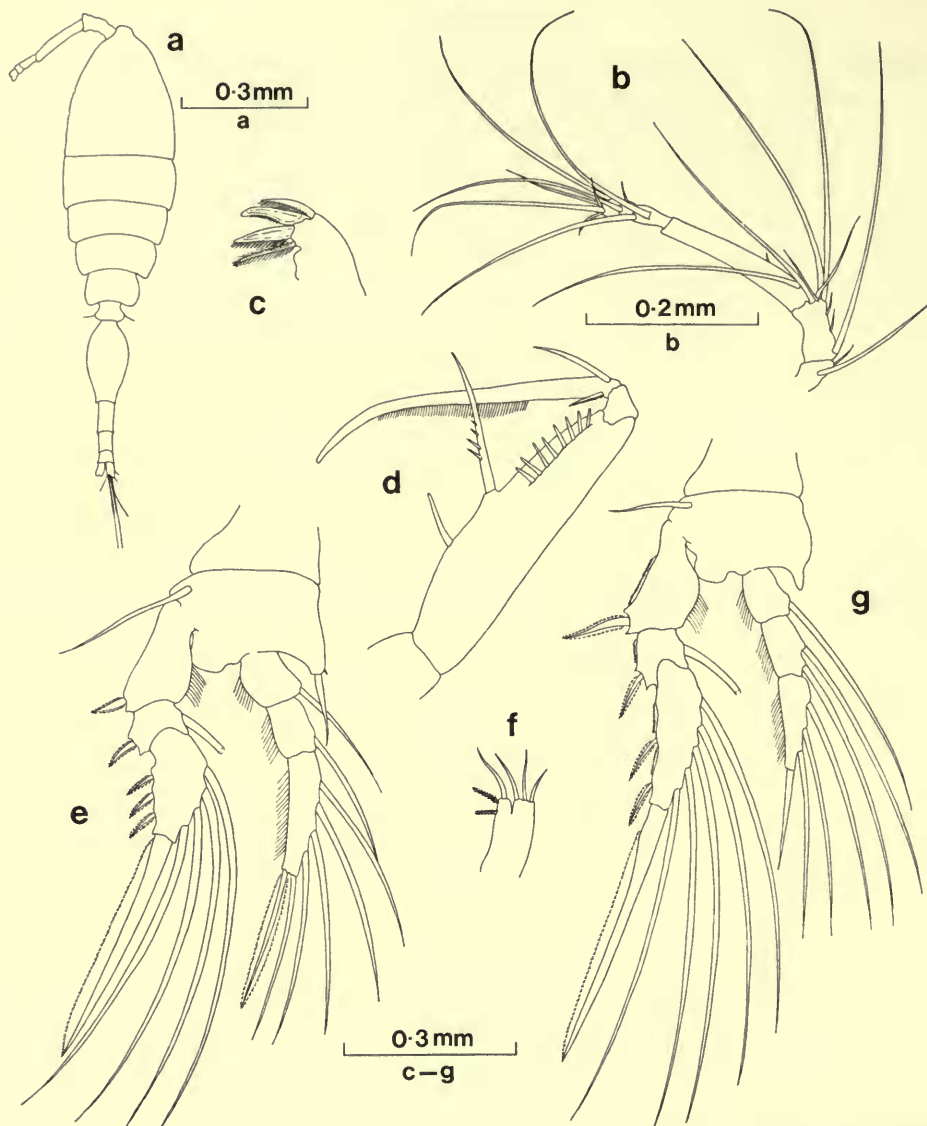


FIG. 22. *Conaea gracilis*. a, female entire, dorsal; b, first antenna, ventral; c, mandible, anterior; d, maxilliped, anterior; e, leg I, posterior; f, first maxilla, posterior; g, leg 2, posterior.

First antenna (Fig. 22b) 6-segmented, third segment constituting about half the length of the appendage; number of armature elements per segment I - 2, II - 8, III - 2, IV - 2, V - 2, VI - 5.

Second antenna (Fig. 23d) 3-segmented; first segment armed with an inner seta and a row of spinules on the inner margin; second segment with a proximal row of spinules on the inner margin and a distal row of setules on the outer margin; third

segment elongate bearing a large seta and 2 spinules proximally, a row of denticles on the anterior surface and an apical group of 4 setae and a spinule.

General form of mandible (Fig. 22c) as in *Oncaea* ; armature comprising 2 terminal blades each with a row of spinules, an outer spinulate seta and an inner hirsute seta.

First maxilla (Fig. 22f) bilobed ; outer lobe bearing 3 setae apically, inner lobe with 2 apical and 1 lateral seta.

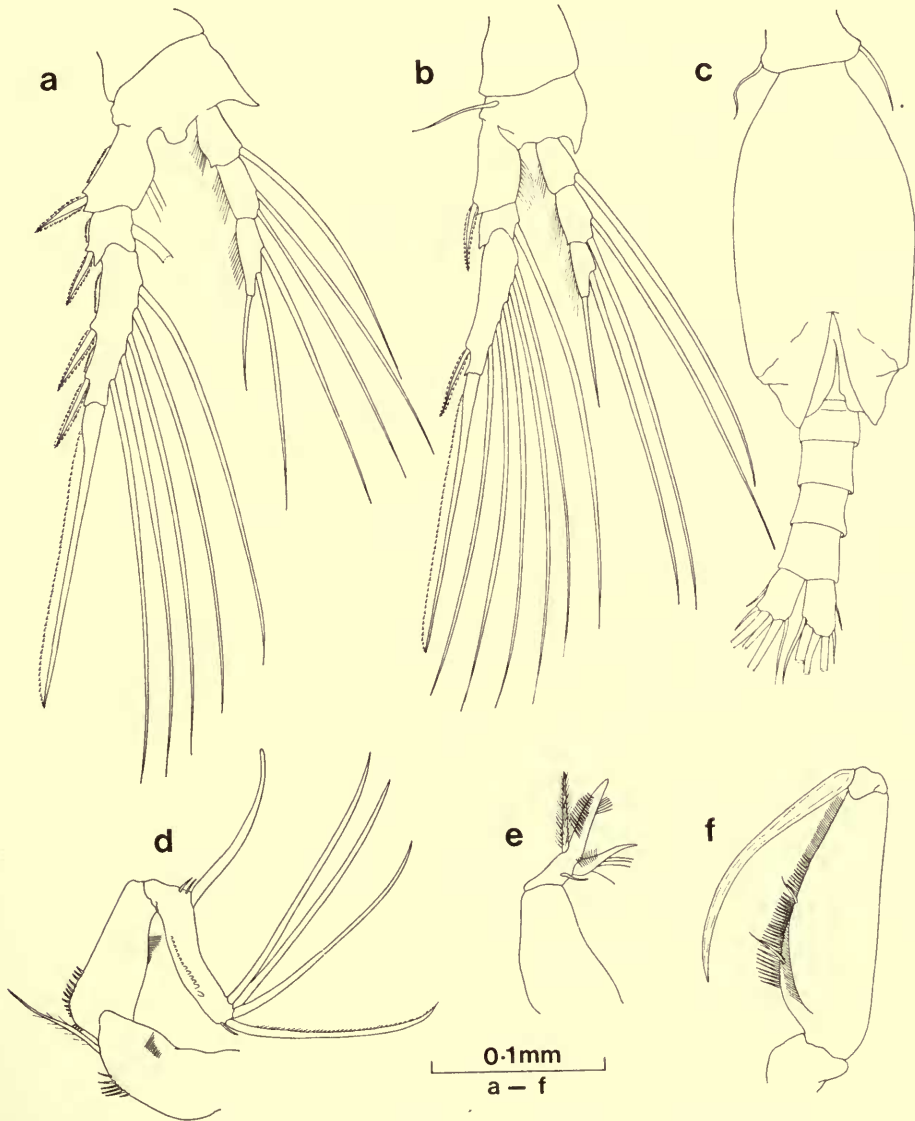


FIG. 23. *Conaea gracilis*. a, female leg 3, posterior ; b, leg 4, posterior ; c, male urosome, ventral ; d, female second antenna, anterior ; e, second maxilla, anterior ; f, male maxilliped, anterior.

Second maxilla (Fig. 23e) 2-segmented; distal segment terminating in a large spinulate process and bearing a hirsute seta, a spine armed with 2 rows of spinules and a small setule.

Maxilliped (Fig. 22d). Second segment with a short naked proximal seta, a long distal seta with 4 spinules and a row of 8 robust spinules near the inner margin; terminal segment claw-like with an inner and an outer basal seta and a row of fine spinules on its concave margin.

Legs 1-4 (Figs 22e, g & 23a, b). Armature formula as given in generic diagnosis. Rows of setules located on the lateral margins of endopod segments 1 to 3 and on the inner margin of exopod segment 1 on all legs. Legs 2 and 3 with strips of serrated membrane on the lateral margins of exopod segments 1 to 3.

Leg 5 reduced to a single plumose seta on the surface of the first urosome segment.

Body length of female ranging from 0.88 to 1.05 mm, with a mean of 0.96 mm.

Male. Urosome (Fig. 23c) 6-segmented; genital complex about 1.7 times longer than rest of urosome; caudal rami similar in length to anal somite and about 1.7 times longer than broad.

Appendages as in ♀ except for first antenna and maxilliped.

First antenna 4-segmented with the 3 distal segments of the female first antenna fused, armature elements per segment I - 2, II - 8, III - 2, IV - 9.

Maxilliped (Fig. 23f). Second segment with a row of fine spinules along the inner margin divided into 2 rows proximally and with 2 slender unarmed setae; terminal segment forming an unarmed claw.

Body length of male ranging from 0.76 to 0.86 mm, with a mean of 0.81 mm.

MATERIAL EXAMINED. 3912 ♀♀ and 99 ♂♂; from samples 4, 5, 8, 9, 11-17, 22-25, 29, 32 & 34. BM(NH) registration numbers: ♀♀ 1976.206-215 and ♂♂ 1976.216-225.

REMARKS. *C. gracilis* is the only species of the genus and is readily distinguished from species of *Oncaea* by the greater length of the urosome somites as well as by differences in the appendages.

PACHOS Stebbing, 1910

Pachysoma Claus, 1863: 162. (preocc.)

DIAGNOSIS. Oncaeidae. Body globular with very inflated prosome and short 4 (♀) or 5 (♂) segmented urosome. Rostrum prominent. Second antenna 4-segmented. Mandible reduced to a curved lash. First maxilla bilobed; outer lobe with 3 setae. Second maxilla with 2 apical elements. Maxilliped 3- or 4-segmented; terminal segment claw-like especially in ♂. Legs 1-4 with 3-segmented rami, armature formula:

	Coxa	Basis	Endopod	Exopod
Leg 1	0-1	1-0	0-1; 0-1; 0, I, 5	I-0; I-1; III, I, 4
Leg 2	0-1	1-0	0-1; 0-2; I, II, 3	I-0; I-1; III, I, 5
Leg 3	0-1	1-0	0-1; 0-2; I, II, 2	I-0; I-1; III, I, 5
Leg 4	0-1	1-0	0-1; 0-1; 0, II, 0	I-0; I-1; II, I, 5

Leg 5 a conical process with 2 short apical setae. Leg 6 represented by 2 long plumose setae.

TYPE-SPECIES. *Pachos punctatum* (Claus, 1863).

The genus *Pachos* comprises 3 species; *P. punctatum*, *P. tuberosum* (Giesbrecht, 1891) and *P. dentatum* (Mori, 1932). The species can be separated using the following key:

KEY TO FEMALES OF THE GENUS *Pachos*

- | | |
|--|---------------------|
| 1. Dorsal surface of carapace ornamented with minute denticles | 2 |
| Dorsal surface of carapace ornamented with a reticulate pattern of minute chitinous ridges | <i>P. tuberosum</i> |
| 2. Maxilliped 3-segmented | <i>P. punctatum</i> |
| Maxilliped distinctly 4-segmented | <i>P. dentatum</i> |

KEY TO MALES OF THE GENUS *Pachos*†

- | | |
|---|---------------------|
| Maxilliped claw with broad spatulate tip | <i>P. punctatum</i> |
| Maxilliped claw with a narrow pointed tip | <i>P. tuberosum</i> |

Pachos differs markedly from the other genera of the Oncaeidae and Sars (1918) regarded its systematic position in this family as rather questionable. The aberrant structure of the mouthparts in *Pachos* is the prime factor isolating this genus from the rest of the family. However, detailed comparison with *Lubbockia*, for example, demonstrates that the basic structure of each limb is the same. The mandible in *Pachos* is reduced to a curved lash with denticles on the outer surface and a row of bristles on the inner surface. This condition could readily be derived from that in *Lubbockia* (cf. Fig. 4d) by the loss of the additional proximal armature elements. The first maxilla is bilobed in both genera. The second maxilla is 2-segmented in both although again there is a reduction in the number of armature elements in *Pachos*. The structure of the maxillipeds is very similar with 2 setae present on the second segment and with the distal segment forming a claw bearing at least 1 proximal spinule. The second antenna is 4-segmented in *Pachos* but only 3-segmented in *Lubbockia*; however, the distal segment of the second antenna in *Lubbockia* probably represents the fused third and fourth segments of this appendage in *Pachos* and the outer margin setae halfway along the third segment in *Lubbockia* represent the vestiges of the armature elements found on the third segment in *Pachos*. Such detailed comparisons show that the relationships of *Pachos* probably lie with the family Oncaeidae.

Pachos punctatum (Claus, 1863)

Pachysoma punctata Claus, 1863: 163, pl. XXV, figs 6-11.

Pachysoma punctatum: Giesbrecht, 1892: 612-615, pl. 48, figs 22-36, 38, 39.

DESCRIPTION. *Female*. Body globular, with inflated prosome and short urosome; surface of carapace covered with minute denticles; a pair of sensory setules

† The male described by Mori (1932 & 1937) as the male of *P. dentatum* does not differ significantly from *P. tuberosum* (see p. 154) and is not included in the key.

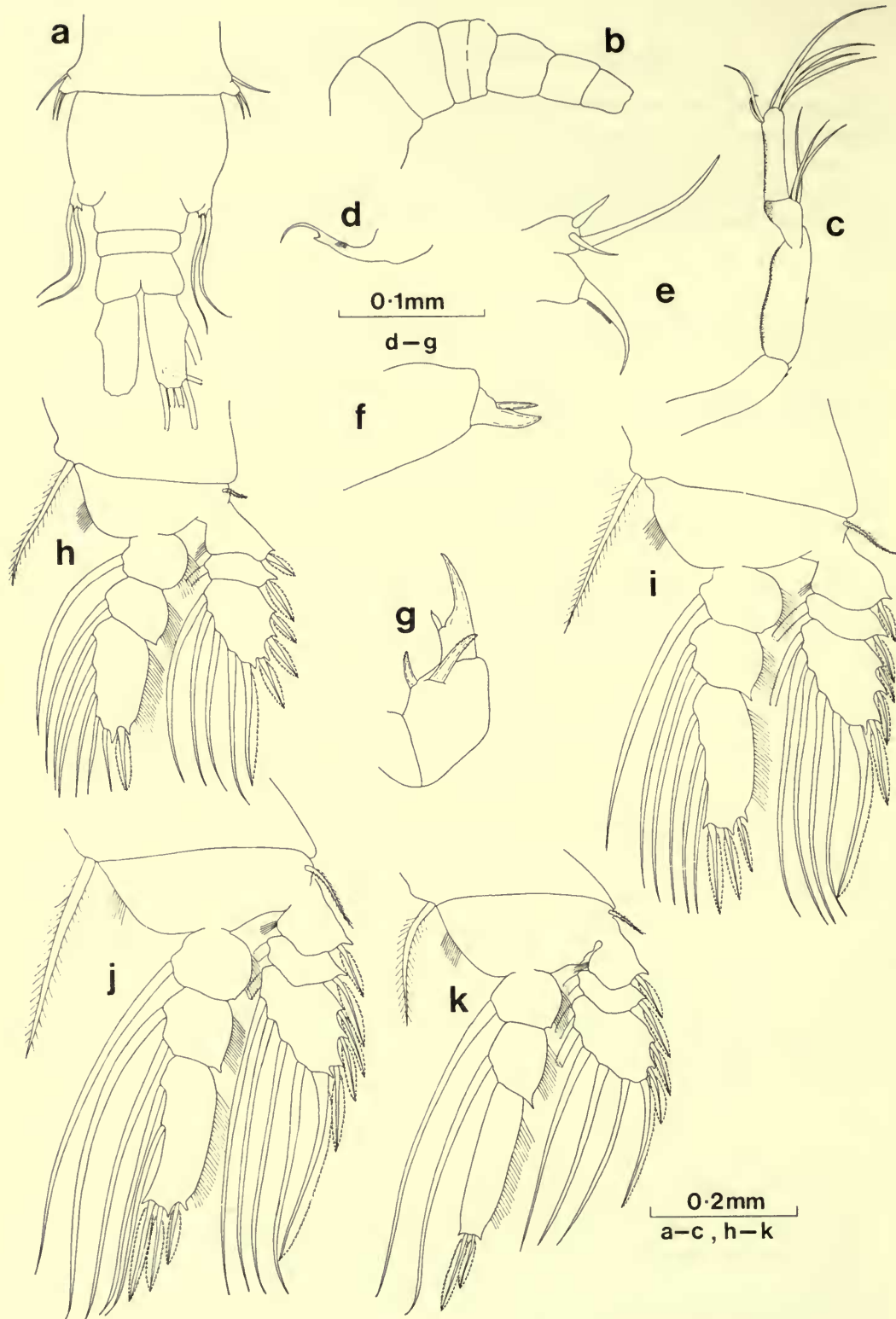


FIG. 24. *Pachos punctatum*. a, female urosome, ventral; b, first antenna (segmentation only), ventral; c, second antenna, anterior; d, mandible, anterior; e, first maxilla, anterior; f, second maxilla, anterior; g, maxilliped, antero-ventral; h, leg I, posterior; i, leg 2, posterior; j, leg 3, posterior; k, leg 4, posterior.

present on carapace and each of remaining 3 prosome somites. Rostrum prominent. Postero-lateral corners of last prosome somite rounded; 2 urosome somites posterior to genital complex. Caudal rami about 2.2 times longer than broad, armed with a lateral seta just proximal to the mid point of the ramus.

First antenna (Fig. 24b) 7-segmented; armature elements per segment I - 8, II - 12, III - 4, IV - 3, V - 4, VI - 3, VII - 7.

Second antenna (Fig. 24c). First segment with 2 minute spinules at inner distal angle; second segment with a single spinule on inner margin; third segment short with 3 slender setae at inner distal angle; fourth segment with 4 long apical setae and 2 shorter subapical setae. Segments 2 to 4 with dense patches of minute denticles on their inner surface.

Mandible (Fig. 24d) produced into a slender lash with wide base; armature reduced to a single denticle on the outer margin and a short row of fine bristles near the inner margin.

First maxilla (Fig. 24e) bilobed; inner lobe with 1 curved seta, outer with 1 short and 2 long apical setae.

Second maxilla (Fig. 24f) 2-segmented; terminal segment forming a curved element distally and with a proximal spine.

Maxilliped (Fig. 24g) 3-segmented, comprising an unarmed basal segment, a robust middle segment with 2 stout denticulate setae, and a claw-like terminal segment bearing a short seta proximally.

Legs 1-4 (Figs 24h-k) with 3-segmented rami; endopod larger than exopod in all legs; armature formula as in generic diagnosis. Rows of setules present on the inner margins of the basis and exopod segment 1 and on the lateral margins of endopod segments 1 to 3.

Leg 5 a short conical process with 2 apical setae and a lateral seta located near its base.

Leg 6 represented by 2 long plumose setae situated on the lateral margin of the genital complex.

Body length of single female specimen 2.25 mm.

Male. Body similar to ♀ in general facies (Fig. 25a); urosome with 3 somites posterior to genital complex; minute denticles and sensory setules present on carapace and prosome as in ♀. Anal somite with a discontinuous row of spinules on ventral surface near the posterior margin; caudal rami (Fig. 25c) as in ♀ but possessing several spinules located on the distal portion of the ventral surface.

Appendages as in ♀ except for first and second antennae and maxilliped.

First antenna (Fig. 25b) 7-segmented; armature elements per segment I - 6, II - 12, III - 5, IV - 3, V - 3, VI - 2, VII - 7 (armature incomplete).

Second antenna differing from that of ♀ in having only 3 apical setae on the terminal segment instead of 4.

Maxilliped (Fig. 25d) 4-segmented; comprising a broad basal segment, a second segment with an inner proximal swelling armed with 2 setae and covered with fine spinules, a small unarmed third segment and a fourth segment forming a curved claw with a spatulate tip and armed with 2 unequal setae at its base.

Body length of single male specimen 2.20 mm.

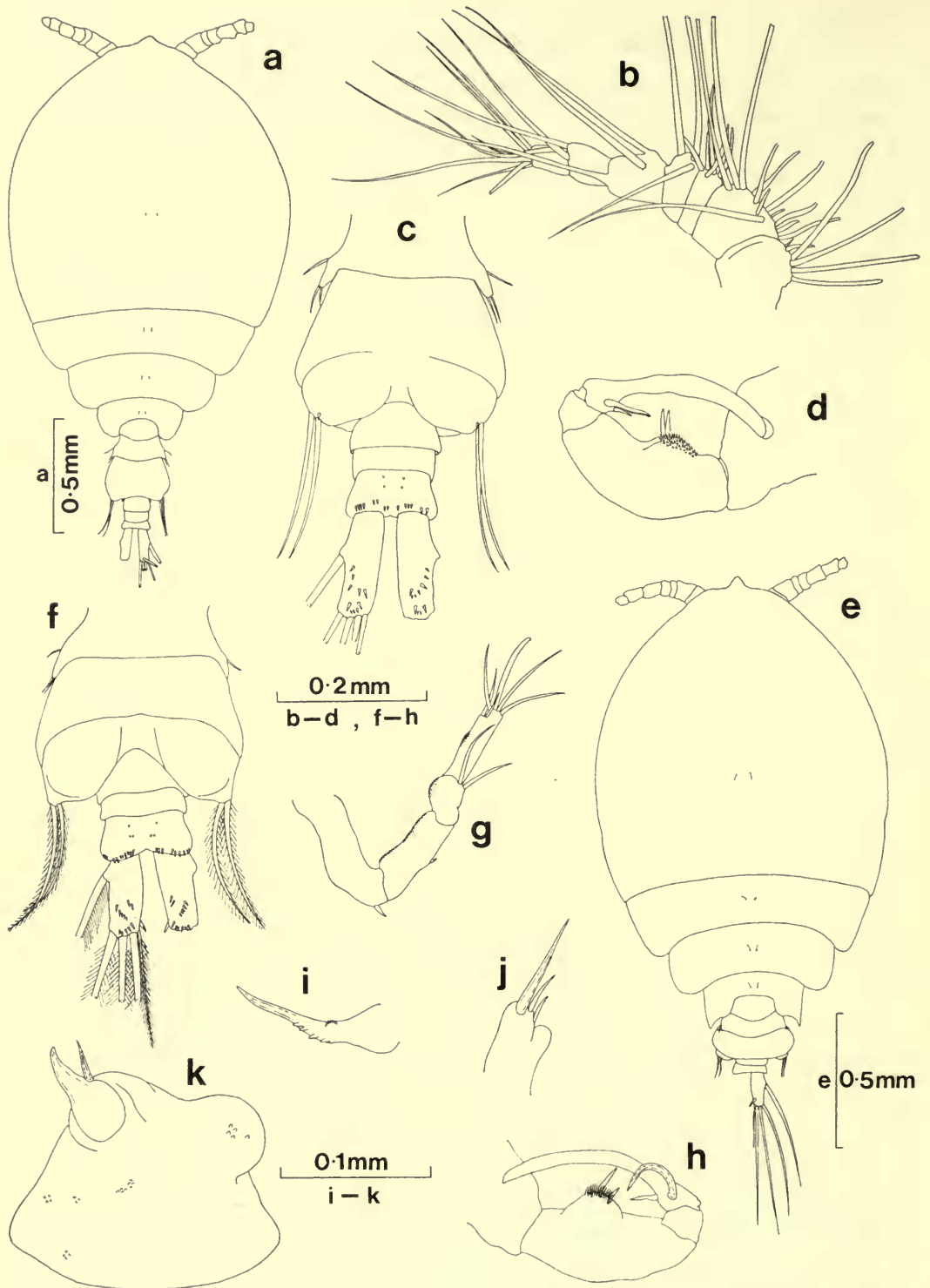


FIG. 25. *Pachos punctatum*. a, male entire, dorsal; b, first antenna, ventral; c, urosome, ventral; d, maxilliped, anterior. *Pachos tuberosum*. e, male entire, dorsal; f, urosome, ventral; g, second antenna, anterior; h, maxilliped, anterior; i, mandible, anterior; j, first maxilla, posterior; k, second maxilla, ventral.

MATERIAL EXAMINED. 1 ♀ and 1 ♂: from samples 25 and 23 respectively; BM(NH) registration numbers: 1976.226 and 1976.227.

REMARKS. The segmentation of the first antenna appears to be rather variable in this species. Claus (1863) recorded 8 segments in the female whereas Giesbrecht (1892) found 5 in the female and 7 in the male. This apparent variation is probably due in part to the difficulty of determining the precise segmentation of the densely setate proximal portion of the first antenna. Seven distinct segments were observed in both sexes of *P. punctatum* although some degree of fusion was observed between segments 3 and 4 in the female.

Pachos tuberosum (Giesbrecht, 1891)

Pachysoma tuberosum Giesbrecht, 1891: 478; 1892: 612, pl. 48, fig. 37.

Pachysoma dentatum Mori, 1932: 172, 176, pl. V, figs 1-6 (male only).

DESCRIPTION. *Male*. Body globular (Fig. 25e) as in *P. punctatum*; prosome inflated but more elongate than in ♂ *P. punctatum*; rostrum very conspicuous from dorsal aspect. Dorsal surface of carapace covered with a reticulate pattern of minute chitinous ridges and with a pair of sensory setules. Posterior angles of last prosome somite produced into slender processes; anal somite bearing a row of spinules on the ventral surface (Fig. 25f). Caudal rami about 2.2 times longer than broad; lateral seta situated approximately a quarter of the distance along the ramus; several spinules present on the distal portion of the ventral surface.

First antenna 7-segmented, armature similar to that of ♂ *P. punctatum*.

Second antenna (Fig. 25g) comprising a basal segment with an inner distal spinule, second segment with a mid inner margin spinule and an outer patch of minute denticles, third segment with 2 setae at the inner distal corner and denticles on the outer surface, fourth segment with 1 stout and 3 slender apical setae, 2 sub-apical setae and a zone of minute denticles on the outer surface.

Mandible (Fig. 25i) produced into a slender lash with 4 denticles on the outer margin and a row of fine bristles near the inner margin.

First maxilla (Fig. 25j) bilobed; inner lobe apparently unarmed, outer lobe with 3 setae.

Second maxilla (Fig. 25k) 2-segmented; basal segment with a large lobe posteriorly; terminal segment tapering into a claw and armed with a single proximal spine.

Maxilliped (Fig. 25h). Second segment with an inner proximal swelling covered with fine spinules and bearing 2 setae; terminal segment forming a claw with a pointed tip and with a short straight seta and a curved seta proximally.

Legs 1-6 as in *P. punctatum*.

Body length of single male specimen 2.00 mm.

MATERIAL EXAMINED. 1 ♂ from sample 27; BM(NH) registration number: 1976.228.

REMARKS. There are no significant differences between the male of *P. dentatum* described by Mori (1932 & 1937) and the male of *P. tuberosum*. Mori found only 1

stout and 4 slender setae around the apex of the second antenna of male *P. dentatum* but the absence of a small seta from the subapical group (cf. Fig. 25g) does not justify specific recognition especially when the seta is easily overlooked. In the armature of the other appendages, in body proportions and in the surface ornamentation of the carapace male *P. dentatum* very closely resembles *P. tuberosum*.

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